NOVEMBER 20, 1950

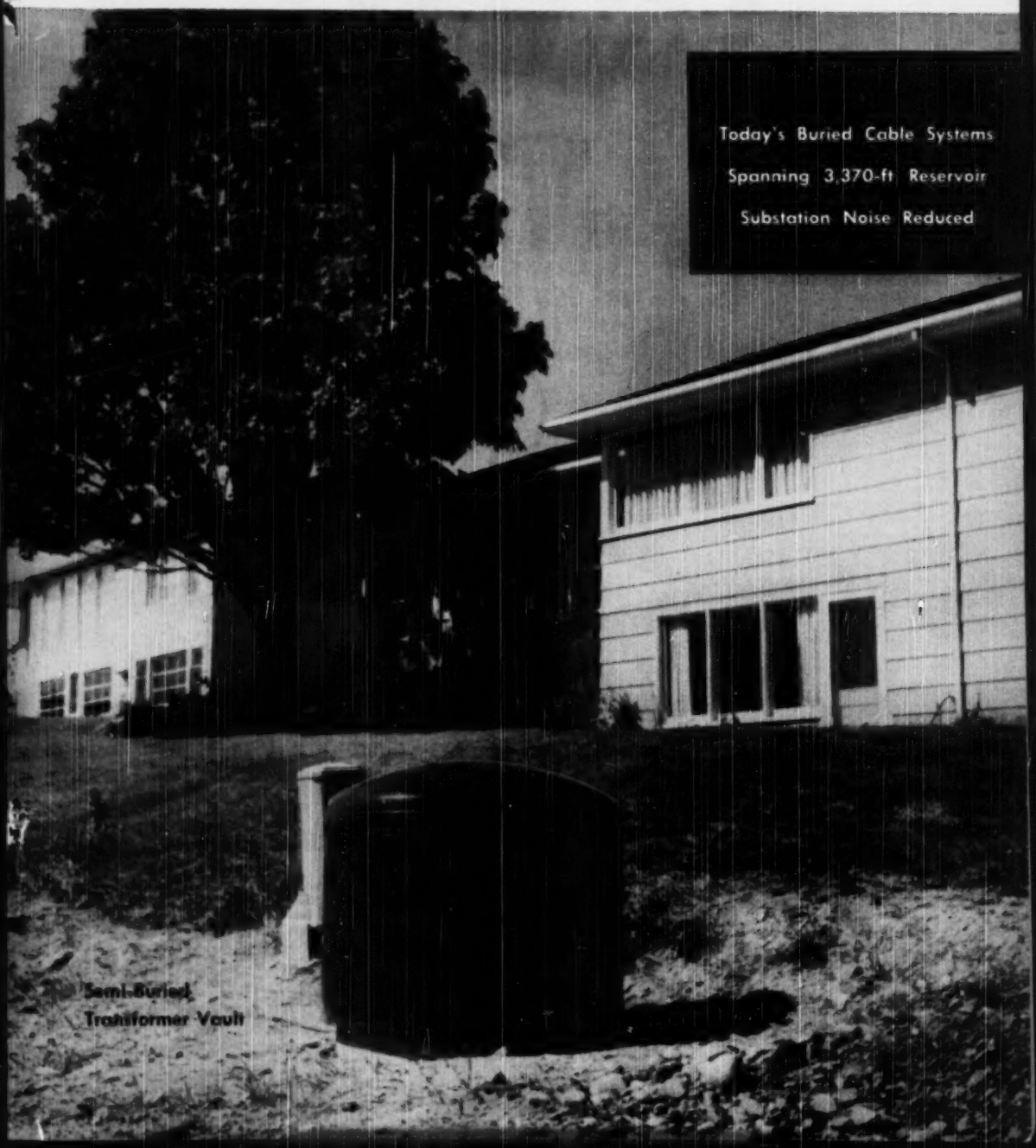
Electrical World

A McGRAW-HILL PUBLICATION

Today's Buried Cable Systems

Spanning 3,370-ft Reservoir

Substation Noise Reduced



Semi-Buried Transformer Vault

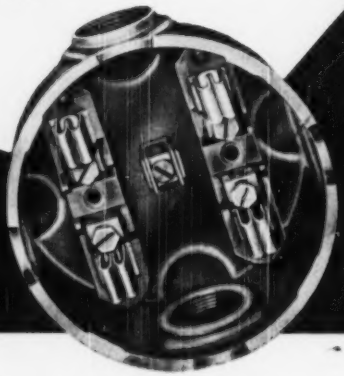
WRENCH IT!
Interlocked—seam hubs won't give, turn or break off!
SOCK IT!
If abnormal abuse should deform the steel, just bend it back again — the interlocked-seam hubs will stay watertight!
DROP IT!
Even screwed onto a twelve-foot length of conduit, this socket takes terrific punishment!

NOW!

NEW STRENGTH!
NEW STAMINA!
NEW ENDURANCE!
in the IMPROVED
Murray
Steel METER SOCKET

How do we do it?

Take a look at this precision interlocked seam that anchors hubs to shell in the improved Murray meter socket. Engineers said it couldn't be done — yet here it is. Rigid . . . rugged . . . waterproof — these hubs *can't* loosen up, *can't* fall out, *can't* break off. No welds, no die castings, no flimsy alloys — just tough, sturdy, dependable steel.



Murray
MANUFACTURING CORPORATION
50 Years of Service to the Electrical Industry
1250 ATLANTIC AVENUE • BROOKLYN 16, NEW YORK

The *improved* Murray steel meter socket is weatherproofed by zinc coating and baked-on melamine finish. Two or three hubs, size 1" or 1¼"; four, five or six jaws. Reversible jaws for horizontal or vertical mounting. Solderless connectors can be swung into the gutter for bussing. Connectors take No. 1 wire.

The *improved* Murray meter socket is available either separately or in this preassembled yard-pole combination with Murray fully magnetic circuit breaker protection, approved by R.E.A. Write for complete specifications.

SERVICE ENTRANCE & METER EQUIPMENT • MAGNETIC CIRCUIT BREAKERS
SWITCHES • CURRENT LIMITING REACTORS • CROWS NEST AERIAL LADDERS

SOME THINGS TO WATCH FOR IN COMING ISSUES

For quite a while now, utility men have realized that the residential load is growing too fast and getting too big for the present 5- and 15-amp meters.

A higher rated meter is on the way. But what is the best rating? Generally, industry thinking has appeared to point rather strongly toward 50 amp.

E. L. Keller, meter superintendent at Duquesne Light, tells us why his company settled on 30 amp instead of a higher rating when they recently purchased 4,000 new meters.

ANOTHER SURVEY FROM THE AIR

You probably remember a story **Electrical World** ran back in April telling how West Penn Power used an aerial photo technique to make profile maps of a transmission line route through rugged terrain.

Along comes Philadelphia Electric with another highly ingenious use for the same method of aerial survey—making coal pile inventory. Flying slowly over their ten coal piles, surveyors can get the necessary photographs in half a day. Under the lense of a Kelsh plotter these photos show profiles, and the amount of coal on hand at a given time can be accurately estimated.

It's cheaper, quicker and more accurate than the old methods of ground surveying which is so slow that by the time all coal piles are measured, enough fuel has been used to make extensive adjustment necessary in order to get an accurate estimate. But with the aerial method you get a fast "snapshot" of existing stocks at a given time. You also get a useful and interesting story for **Electrical World.**

When senior associate editor Arch Knowlton explains **Electrical World's** "steam plant philosophy," he sounds something like this: "Always remember that **Electrical World** is interested in **WHY.** Years ago, technical reporting used to deal with when, what, where, including the number of pounds of concrete in a new station. But we now report the engineering reasoning behind changes and innovations. We'll stick to **why.**"

This policy is evident in **Electrical World's** report on Niagara-Mohawk's new Dunkirk Station, which makes it a generation article well worth watching for.

THE EDITORS

Electrical World

Published for 76 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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Plus Factors OKOLITE-OKOPRENE Your Best Buy in Electrical Cable

From the inside out, every component of Okonite cable has a *plus value* which adds to cable life. That's because the Okonite manufacturing process carries on from where conventional cable design leaves off. The finished cable is a combination of all these exclusive Okonite developments—the best that modern research and manufacturing techniques can produce.

CONDUCTORS — not "tinned", but Okoley-coated.

INSULATION — not just rubber, but natural Wild Up-River Fine Para rubber.

PROTECTIVE COVERING — not just another neoprene compound, but the pioneer, time-proved Okoprene formula.

PROCESSING — not the commonly used extrusion method, but the famous Okonite pretision strip-process.

VULCANIZATION — not with life-shortening "double-cure", but with strength-retaining single vulcanization in a metal mold.

TESTING — not just a single voltage test, but both high voltage a-c and super-voltage d-c tests.

Wild Up-River Fine Para rubber is received in "biscuits" from the head waters of the Amazon River in Brazil.

Experts pretty well agree that natural rubber provides the most reliable electrical cable insulation where circuit security and long life are prime considerations.

Though Okonite research engineers were the first to employ synthetics in wires and cables, experience has taught them that you dare not place the same reliance on their *anticipated performance* based on laboratory tests as you can on the long *established service record* of natural rubber.

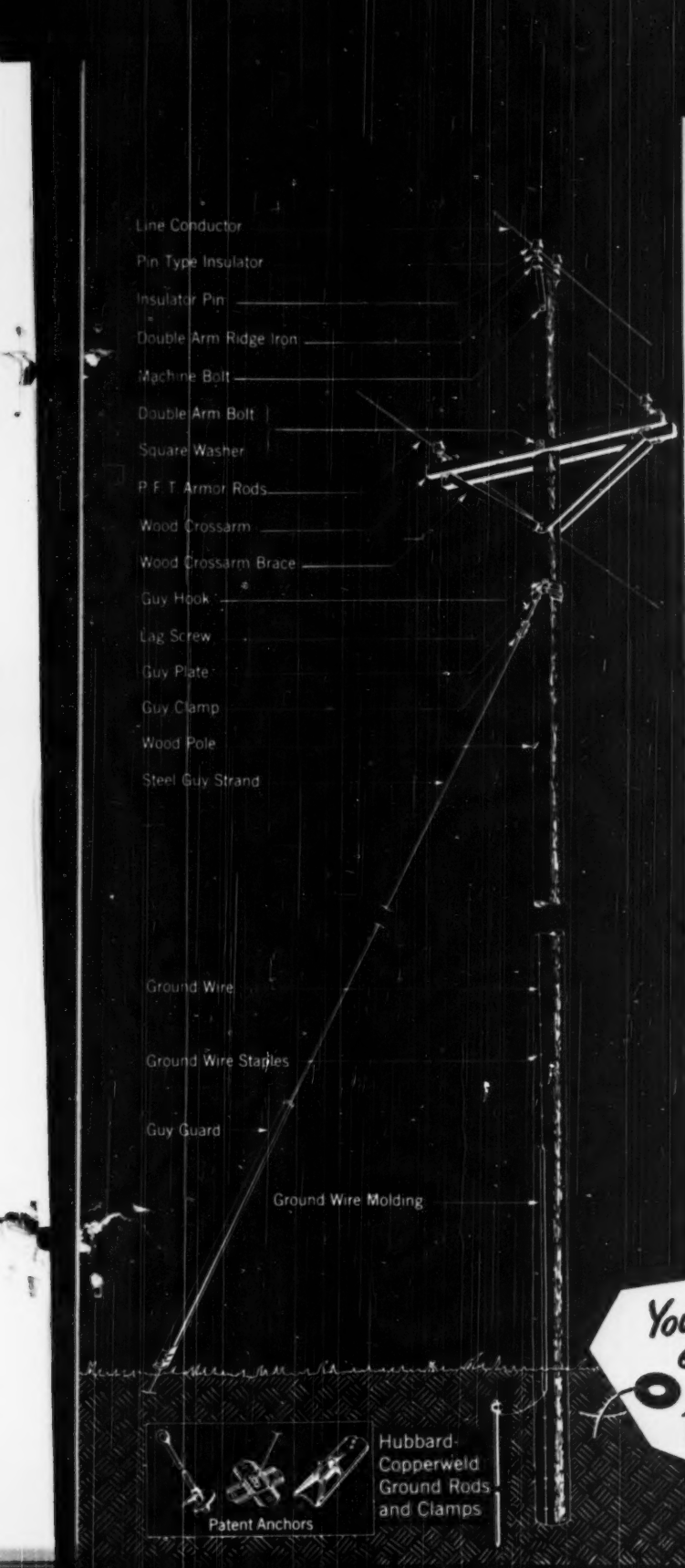
However, there is a marked difference in natural rubbers, too. Plantation grades show a decided variation in quality; none has the uniformity, aging properties and superior performance of premium grade wild rubber.

Such a rubber is Wild Up-River Fine Para—*the only rubber used in Okolite-Okoprene.* For three-quarters of a century Wild Up-River Fine Para has been the basis of Okonite insulations. Instances have been recorded of its staying electrically sound for as long as 50 years.

Wild Up-River Fine Para rubber insulation is only one of the six principal plus factors which contribute to the extra-long life of Okolite-Okoprene. For more detailed information, write for Bulletin EW-1014, to The Okonite Company, Passaic, N. J.

THE BEST CABLE IS YOUR BEST POLICY

OKONITE — *insulated wires and cables*



From a single near-by source

everything from the bottom of the hole to the top of the pole

Why spend time shopping around for pole-line equipment and supplies? From near-by Graybar you can fill all your requirements with just one order—and be sure you're getting dependable items. By ordering all your pole-line needs from this single source, you save time and paper-work expense. You get the products of the leading manufacturers of poles, crossarms, insulators, hardware, strand, line trucks and tools.

As conditions permit, Graybar stocks many pole-line items in local warehouses in more than one hundred cities. By scheduling ahead with Graybar, you're sure of the best possible chance of having all your requirements filled and on the job site when needed.

When you call on Graybar, for supplies or for information, your needs are understood and accurately met. That's because Graybar has been familiar with pole-line requirements ever since the first lines went up. Experienced Graybar Outside Construction Specialists are on call to help you solve unusual problems in the planning of any pole-line or underground project. *Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.*

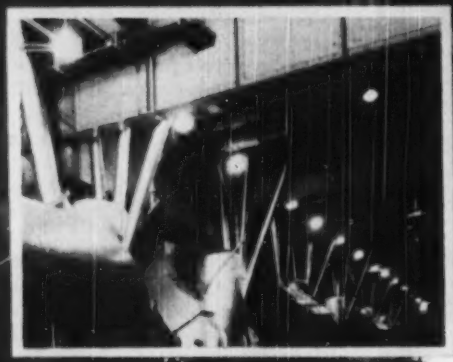
5035

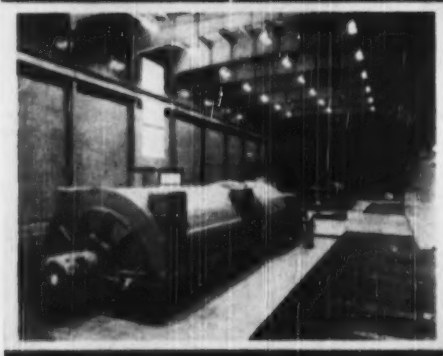
IN OVER 100 PRINCIPAL CITIES

You get the best of everything electrical

Via GraybaR

The Nation's Foremost GENERATING PLANTS are equipped with HOLOPHANE Lighting





Through more than two generations Holophane Engineering has concentrated on the design and development of specialized lighting equipment for generating stations... In the Pennsylvania Power and Light Company's new Sunbury plant (Ebasco Services Inc. were the consulting engineers and general contractors under the supervision of the Engineering and Construction Dept. of the P. P. & L. Co.) Holophane Lighting systems were extensively used . . . The Sunbury plant is exceptionally well illuminated, the minimum level is 25 footcandles throughout with exception of passageways, walkways and coal-conveying areas (minimum of 15 footcandles).

Upper Left: COAL PULVERIZERS using Holophane No. 685 Units. The upward component of light (10% of total) is advantageous in illuminating equipment near ceiling.

Lower Left: The TURBINE ROOM, in the Sunbury Plant has 55 footcandles from triplet Holophane high bay units (combining Mercury and Incandescent).

Background: 66KV SWITCH YARD lighted by Holophane Substation units. Note excellent vertical illumination and effective ground light.

Holophane

Write for latest Holophane Engineering data on Generating Station Lighting, sent without charge

HOLOPHANE COMPANY, INC.

Lighting Authorities Since 1898 • 342 MADISON AVENUE, NEW YORK 17, N.Y.

THE HOLOPHANE COMPANY, LTD., THE QUEENSWAY, TORONTO 14, ONTARIO

11 YEARS on the Line

✓ No Maintenance
✓ No Downtime

THIS ROCKING CONTACT VOLTAGE REGULATOR has been on the line without downtime or maintenance since installed eleven years ago!" says Mr. Kudick, engineer-in-charge of the East Wells Street Power Station of the Wisconsin Power Company in Milwaukee. "This regulator was installed to hold down voltage peaks . . . it does the job. Performance has been excellent."

What are reasons behind this typical performance?

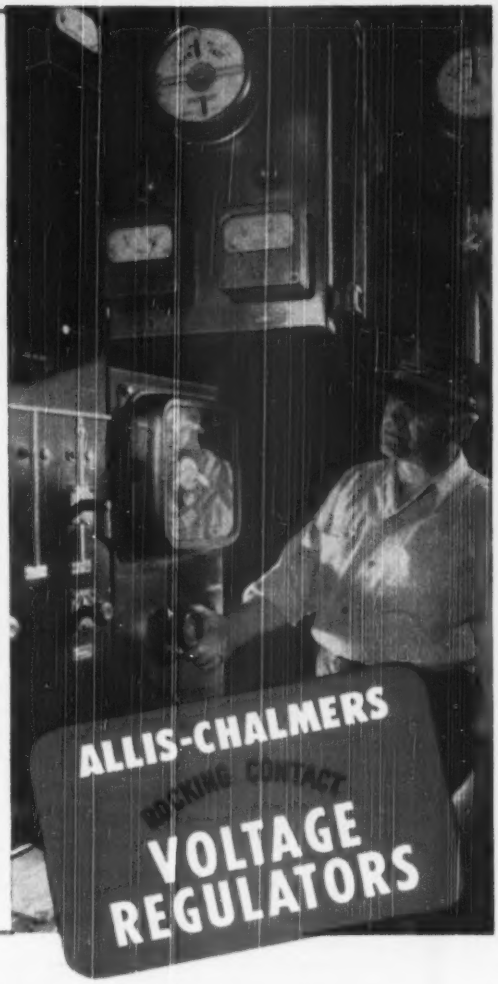
1. Allis-Chalmers Rocking Contact Generator Voltage Regulators have no vibrating contacts, no gliding friction, no complex adjustments. The few moving parts are all supported in jeweled bearings.

2. They are genuinely precision manufactured. Sectors rock on accurately machined commutator segments that are silver surfaced for positive contact, long life.

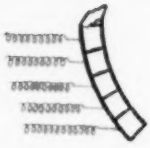
If you want long years of trouble-free service, specify *Rocking Contact* Generator Voltage Regulators for your next switchgear or switchboard . . . or replace inefficient regulation now! Call your nearby Allis-Chalmers representative or write direct for more information.

A-3148

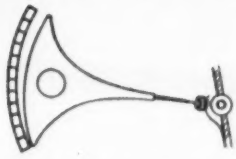
ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.



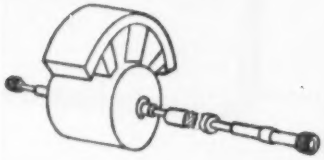
WHY POWER ENGINEERS IN UTILITIES AND INDUSTRY PREFER ALLIS-CHALMERS ROCKING CONTACT REGULATORS:



Each commutator segment is connected to a wire wound resistance element that is accurately designed according to the characteristics of *your* generating equipment. Resistance elements are air cooled—commutator is in dust-tight enclosure.



Rocking Contact sector pivots on jeweled bearing . . . has smooth working, hard graphite face that rocks on curved, silver surfaced commutator . . . regulates with slight movement . . . reduces wear . . . maintains accuracy.



Quick acting torque motor drives Rocking Contact Sector . . . has jeweled bearings for rapid, accurate, anti-friction movement. Aluminum rotor reduces inertia . . . increases speed of response.

ALLIS-CHALMERS

"Just when do I use

It isn't easy to decide what type of insulation to specify for electrical wire and cable. But the job will be a lot easier if you use the experimental and practical knowledge of American Steel & Wire Company engineers. These engineers know that varnished cambric insulation has a combination of properties that are unmatched by any other one insulation.

To start with, varnished cambric is superior to rubber when it comes to heat resistance and load capacity—it can be used at operating temperatures up to 85°C. And, because of its higher dielectric strength, varnished cambric insulation walls can be thinner than rubber. But unlike rubber, varnished cambric requires a waterproof covering if it is to be continuously exposed to moisture.

Paper insulation is more susceptible to ordinary moisture than varnished cambric. And, although varnished cambric is not as flexible as rubber, it is much easier to handle and simpler to install than paper insulated cables.

Varnished cambric has one big advantage over both natural rubber and paper: It is not affected by oil and grease.

Available Types of American Varnished Cambric Cables

CONDUCTORS:	OUTER COVERINGS:	FINISHES:	ARMOR FINISHES:	LEAD SHEATHINGS:	RUBBER SHEATHINGS:
solid	cotton braids	black wax	flat steel tape	plain	where lead
stranded	asbestos braids	firefite	interlocking	jute served	cannot be used
extra-flexible	tape	U.R.C.	metal tape	duck tapes	
annular		slowburning	steel wire	reinforced rubber	
segmental			basket-weave		

Varnished Cambric?"

APPLICATIONS

● Impregnated paper is still the standard insulation for high-voltage operation and general power transmission. And rubber is advisable for most low-voltage installations—or even higher voltages when its moisture resistance and flexibility are particularly valuable.

Varnished cambric follows the middle path, and it is often used in place of rubber or paper because of its properties.

Take a high temperature, low-voltage application. Varnished cambric is often used in place of rubber because of its higher temperature resistance, and resulting greater load capacity.

Varnished cambric is also widely used for medium-voltage (up to 5000 v) transmission lines because it is so easy to install, terminate and join. It is ideal for dry locations, and it can be used without a lead sheath because it is not subject to oil drainage.

Varnished cambric is preferred for general wiring in power stations. Typical examples are: Generator leads, insulated bus bars between oil switches, distribution transformers, etc. Oil and grease resistance of this insulation also make it useful for motor leads and transformer connections.

Perhaps the most common application of varnished cambric insulated cables and wires is for general power distribution within manufacturing plants . . . especially in heavy industries where large blocks of power are transmitted for short distances. Bridges, and other structures which require aerial cables, are often serviced with varnished cambric cables that have a rubber jacket. Rubber jackets are preferable in these locations because lead would probably be ruined by vibration.

Always remember that our engineers are willing to help you solve any wire or cable problem that you may have. And there is no obligation. Write today for Bulletin No. 6195-A "Varnished Cambric Insulated Wires and Cables."

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

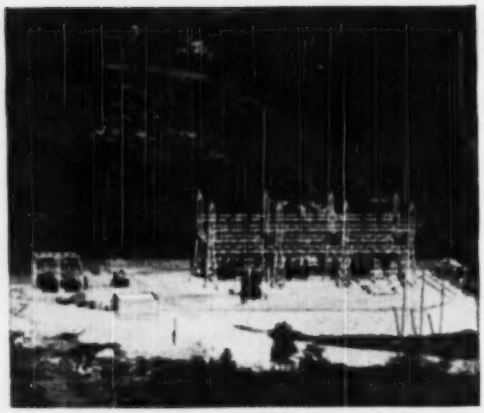
American Varnished Cambric Cables

USS

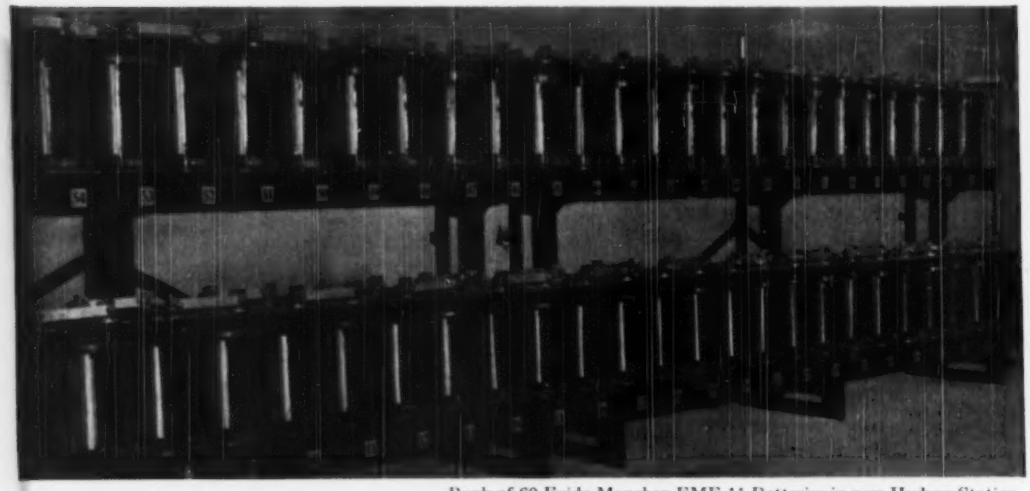
UNITED STATES STEEL

In one of the country's newest and most modern substations...

EXIDE-MANCHEX BATTERIES



New Hudson Substation of Public Service Company of New Hampshire, a unit in the company's large expansion program. (Photo by P.S.Co. of N.H.)



Bank of 60 Exide-Manchex EME-11 Batteries in new Hudson Station.

The new Hudson Substation of Public Service Company of New Hampshire is one of the most efficiently designed and equipped in the country. It's on the Nashua terminus of a 115-kv transmission line from the recently constructed Schiller Mercury Steam Generating Station. Also, it is a terminus of a power exchange across the Massachusetts border.

In the battery room is a 60-EME-11 Exide-Manchex Battery, which is used for switchgear operation, emergency lighting and communication. Considered in its selection were its fine service record and many outstanding features, which include:

- the famous manchester positive plate with its *exclusive* lead button construction.
- slotted plastic separators, impervious to chemical and electrical reaction.
- plastic spacers that maintain plate alignment.
- the latest development in molded glass jars.
- heavy terminal posts with copper inserts for extra conductivity.

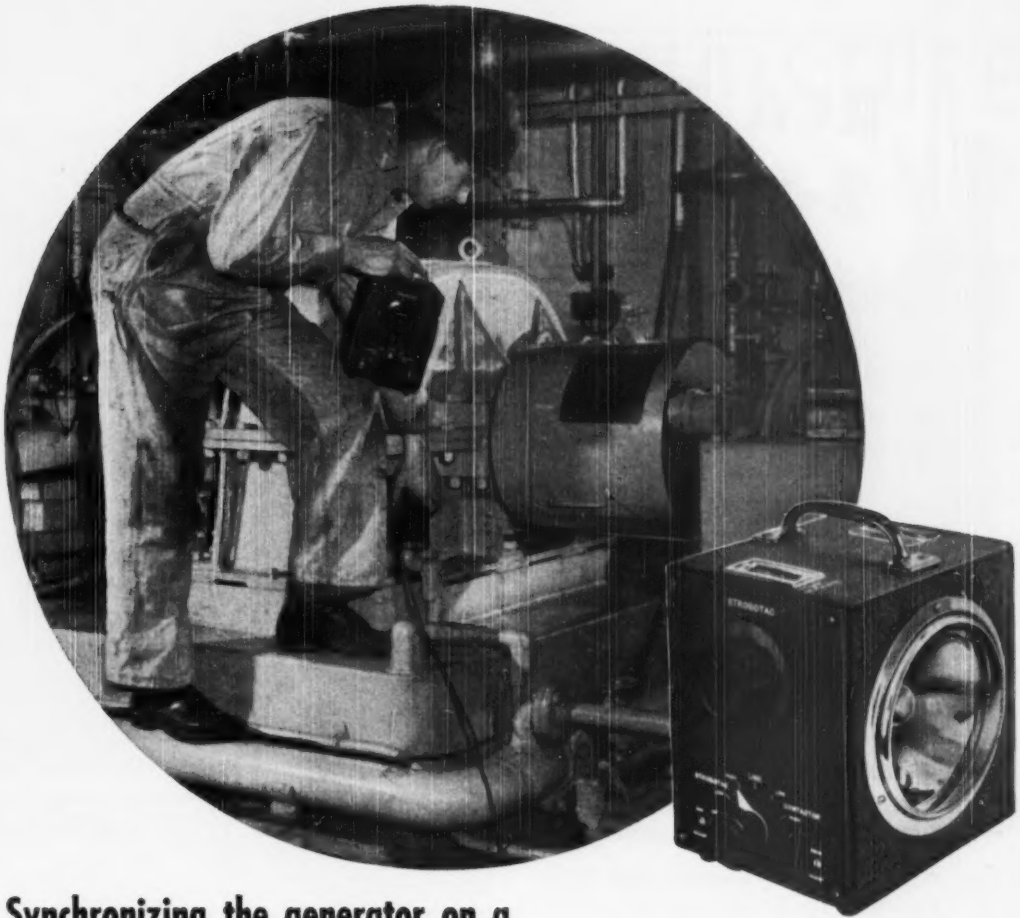
Combined, these and other outstanding characteristics assure you of *positive* switchgear operation. Use the Exide-Manchex for all stationary battery applications in central and substation service.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

Exide Batteries of Canada, Limited, Toronto

"Exide" and "Manchex" Reg. Trade-marks U.S. Pat. Off.

1888 • DEPENDABLE BATTERIES FOR 62 YEARS • 1950



Synchronizing the generator on a 60,000 CFM Turbo-Compressor Unit

The Tidewater Associated Oil Co., Eastern Division, Bayonne, N. J. writes:

"When starting up this Turbo-Compressor, the Strobotac is used as a check on the built-in tachometer until the machine has reached its normal operating speed of 4320 rpm. Coupled to the Turbo-Compressor through a reduction gear unit is a 1500 H. P. Asynchronous generator which must be energized or switched onto the plant 3-phase, 2300 volt electrical system while running at synchronous speed to prevent undue current surge . . . Strobotacs are also used in the Automotive Laboratory when it is necessary to "stop" valve actions, or similar repetitive motions for study."

Here, as in hundreds of instances, the Strobotac flash, by "stopping motion," reveals conditions and causes, effects and defects, previously hidden or obscured.

TYPE 631-B

STROBOTAC®

Direct-Reading Flashing Speed Range: from 600 to 14,400 per minute – stops motion from 100 to 100,000 rpm.

Flash Duration: between 5 and 10 microseconds.

Power Supply: 115 volts, 60 cycles.

Power Input: 25 watts.

Dimensions: 7½ x 8¾ x 9⅞ inches.

Price: $125.00

Write for your 24 page manual of stroboscopic techniques, **"EYES FOR INDUSTRY."**

GENERAL RADIO COMPANY Cambridge 39, Massachusetts

90 West St., New York 6 920 S. Michigan Ave., Chicago 5 1000 N. Seward St., Los Angeles 38

RCA SUPER Carfone 2-way radio system

—for areas where the going is TOUGH!

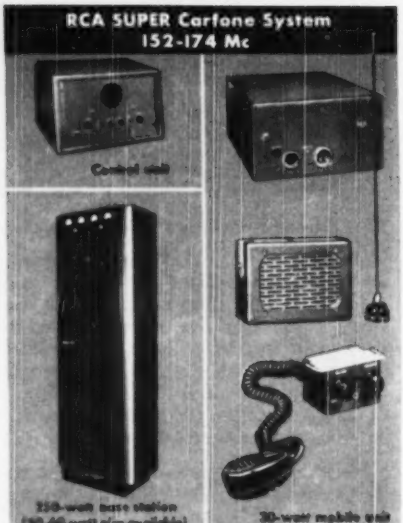
- **Gets through in all kinds of terrain**
- **Causes no interference to neighboring systems**
- **Pierces poor radio locations**
- **Clear reception through interference**
- **Improved message intelligibility**

Now reliable communication in congested metropolitan areas is *a practical reality*—with the RCA SUPER Carfone System.

For example, radio vehicles can operate to within a few feet of adjacent-channel stations without receiving interference. Mobile units have the power to "override" the dead spots—communicate from inside the radio shadows of tall buildings and high hills. In the open country, a SUPER Carfone can increase your coverage *as much as 20%*. And that's not all!

SUPER Carfone Systems are engineered to do away with interference to other services, such as television, air navigation, and neighboring communication systems. Mobile units save substantially on tubes and battery...because they operate at low current on standby. Dynamic balancing reduces mechanical vibration—adds materially to equipment endurance.

Let us put complete information in your hands at once. Write Dept. 51K, RCA Engineering Products, Camden, N. J.—*today!*

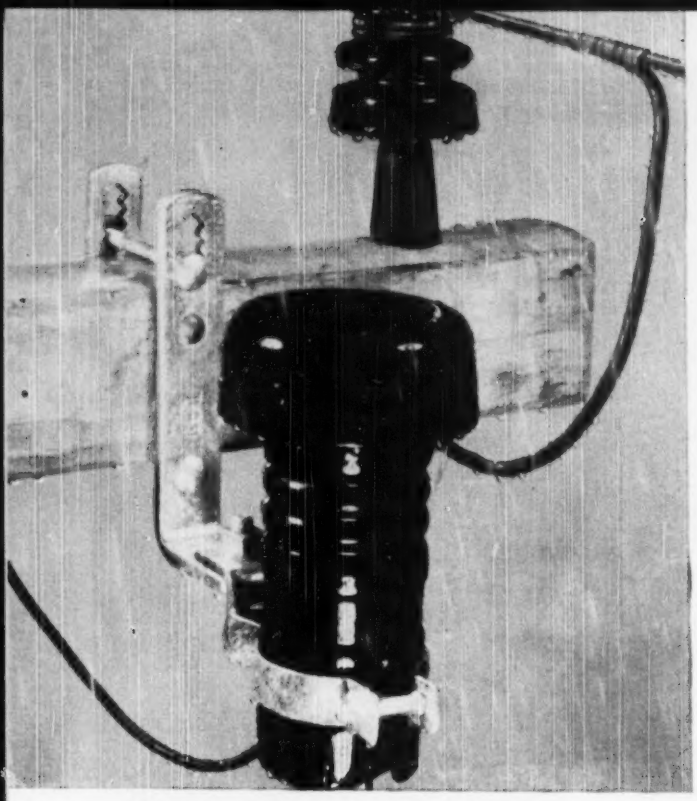


MOBILE COMMUNICATIONS SECTION

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal



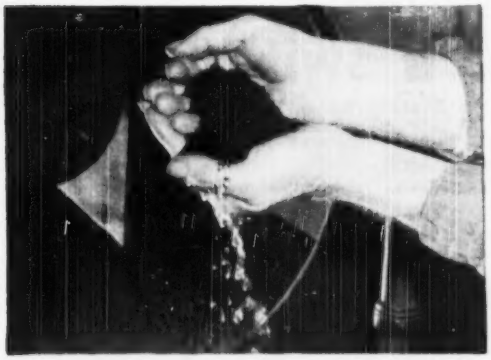
General Electric Pellet Arresters give the same excellent protection to transformer windings in wet weather or dry, in low humidity or high, when new or after years of service. And their low sparkover voltage and low IR drop assure a degree of this protection unexcelled by any other distribution arrester.

MOISTURE doesn't hurt this arrester

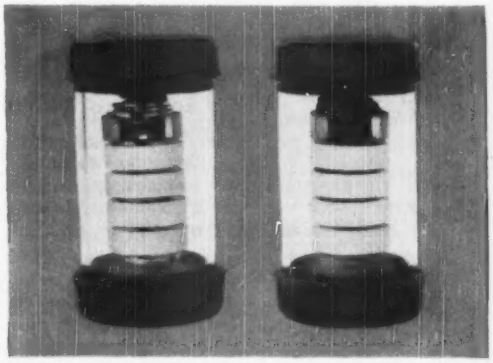
The General Electric Pellet Arrester has a unique valve element that is unaffected by service moisture—and gap electrodes that are sealed in dry nitrogen (N_2)—exclusive features that mean more enduring protection against lightning.

In addition, pellet arresters use inorganic insulation throughout—no internal fiber to "track", carbonize or wear away. Whether valve- or expulsion-type, no other distribution arrester is so unaffected by service moisture.

Write for Bulletin GEA-2975. Apparatus Department, General Electric Company, Schenectady 5, New York.

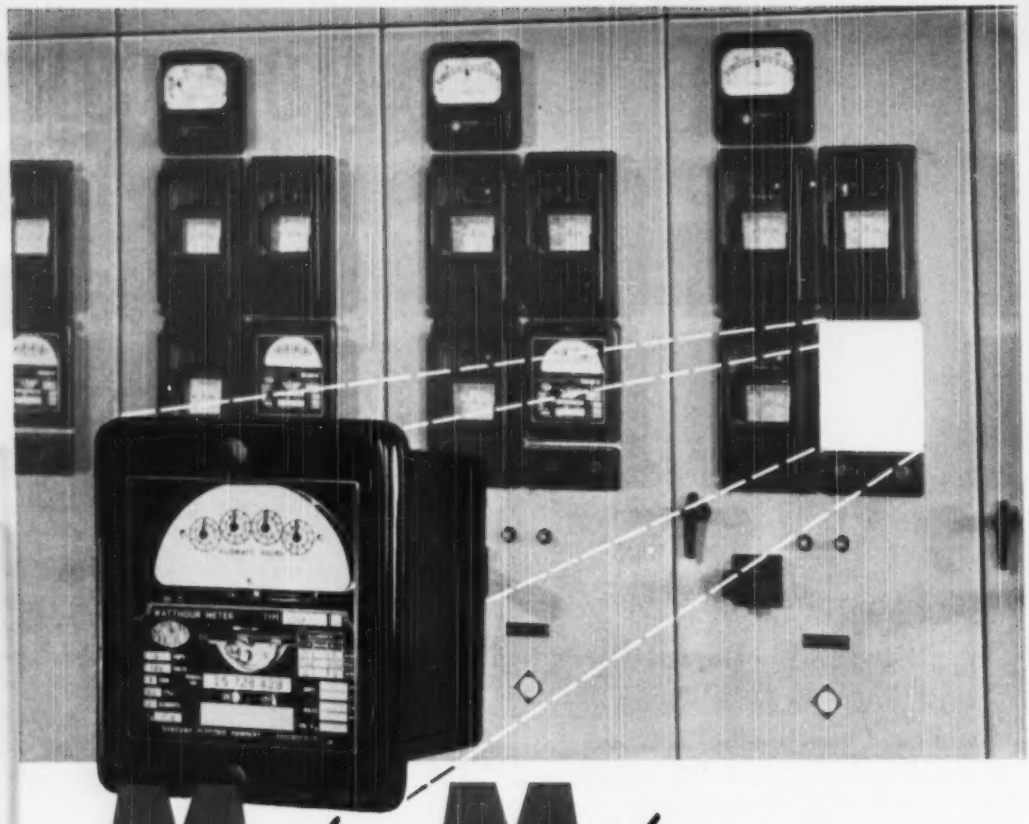


Valve Element Unaffected by Service Moisture! Efficient valve element is a column of lead peroxide pellets—pellets which are actually formed with water in a tumbling barrel (above). Moisture in service causes no change whatever in the unexcelled protective characteristics of this pellet valve column.



N_2-filled Gap Excludes Corrosive Moisture! Here's life-test proof: electrodes at left were sealed in dry nitrogen—those at right sealed in air, and both exposed outdoors under maximum rated voltage. Result: N_2-protected gaps are bright and clean; gaps sealed in air are discolored and corroded.

GENERAL ELECTRIC



Modern Meters for modern switchboards

Sangamo Switchboard Meters have service type elements.

The complete, service-proved line of Sangamo Watthour Meters is now available for semi-flush mounting on modern switchboards.

Type LCF meters, for polyphase circuits, and Type JF meters, for single-phase circuits, are built in all current and voltage ratings for which standard service type watthour meters are made—all require the same minimum switchboard area. These meters are offered with either kilowatthour registers or with registers measuring both kilowatthours and kilowatt demand. Type D5F, two-wire, direct current meters are also furnished in the new design.

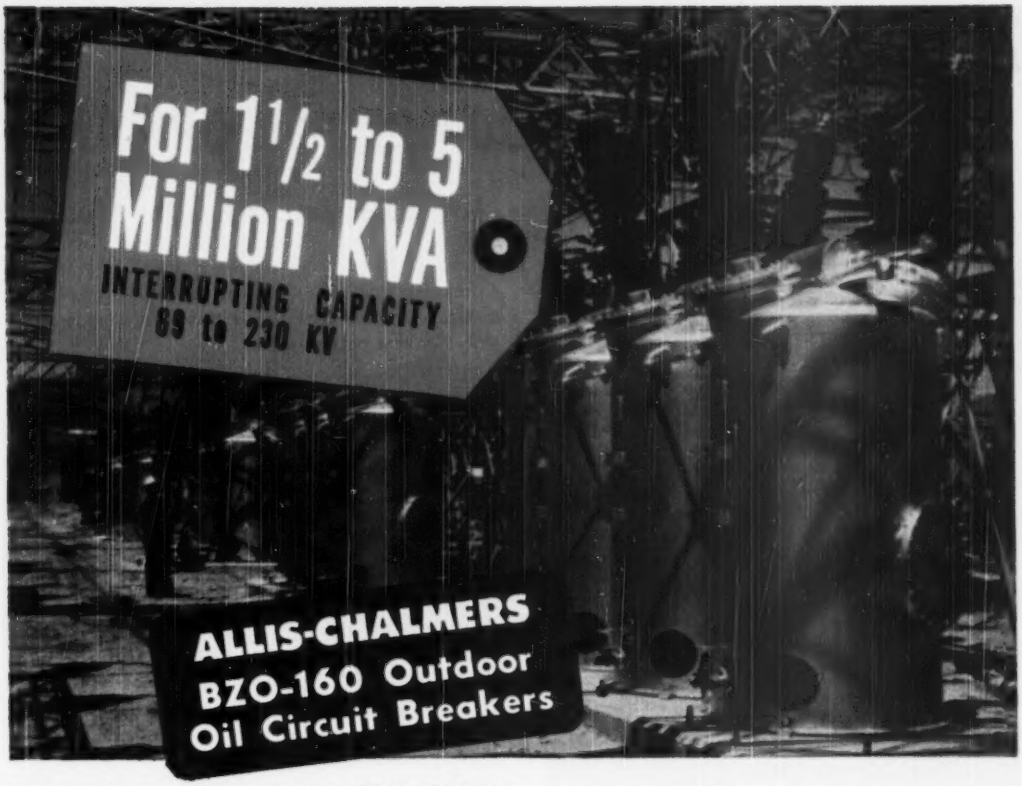
Sangamo Meters for semi-flush mounting fit a $6\frac{3}{8}$" x $6\frac{5}{8}$" opening in the panel and mount with two screws. The cover can be easily removed to permit ready access to the various adjustments for full load, light load, power factor and element balance without removing the meter from the panel. All adjustments can be made from the front with a screwdriver. A micrometer slide-wire device is provided for making accurate power factor adjustments.

Bulletin No. 270 gives complete information. Write for your copy.

SANGAMO

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS



MECHANICALLY TRIP-FREE OPERATOR *affords high-speed opening*

RELIABLE HIGH SPEED FAULT CLEARING AND FAST RECLOSING *for system needs*

EVERY BREAKER COMPLETELY FACTORY ASSEMBLED AND TESTED *before shipping*

MAINTAIN continuity of power service despite transient line faults. The BZO-160 oil circuit breaker clears system faults in 3 to 5 cycles and recloses within 20 cycles to give you protection in ratings 69 kv and higher. Get long-life performance and reliable protection with these BZO-160 features:

1) Mechanically trip-free design gives high-speed contact opening under all operating conditions. Pneumatic operator is uncoupled from the contact mechanism through a positive mechanical linkage. This means that contacts open independent of closing piston position.

2) *Ruptor* interrupter gives split-second arc extinction . . . interrupts load and fault currents with low arc energy release. Reduces oil and contact deterioration to a minimum. Arc resistant alloy contact tips give long contact life with little maintenance.

The BZO-160 performance is based upon more than 50 years of circuit breaker design and manufacturing experience, exacting laboratory and field tests, and years of power service. Simple breaker construction, free of complicated mechanisms, makes inspection easy.

For more information on dependable BZO-160 performance call your A-C sales office or write for new bulletin 71B6022C. A-3074

ALLIS-CHALMERS, 932A SO. 70 ST. MILWAUKEE, WIS.

STANDARD RATINGS

Rated KV	Rated Amp. 60 cycle	KVA Interrupting Capacity*
69	1200	2,500,000
69	2000	3,500,000
115	800	1,500,000
115	1200	3,500,000
138	800	1,500,000
138	1200	3,500,000
138	1200	5,000,000
161	800	3,500,000
161	800	5,000,000
230/196	800	3,500,000
230/196	800	5,000,000
230	800	3,500,000
230	800	5,000,000

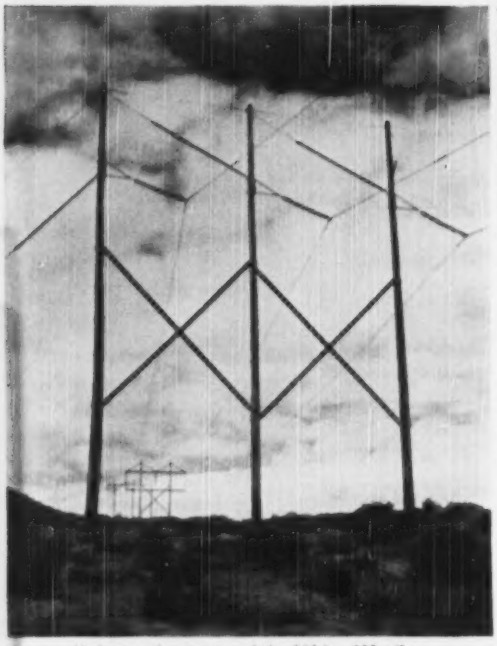
*For information on higher interrupting ratings, get in touch with your A-C sales office.

Ruptor is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Demand PROOF OF PERFORMANCE

for Superior Insulator Quality



Medium-angle structure of the 230-kv, 189-mile line of Idaho Power Company.

● Not long ago, Idaho Power Company built a 230-kv line extending 189 miles across southern Idaho. For this line, they wanted only the best of insulators.

RESULT: For use on their new line, The R. Thomas & Sons Co. was awarded a contract for 40,000 "*Quiet-Type*", 10-inch suspension insulators. Recently, 3000 more were purchased.

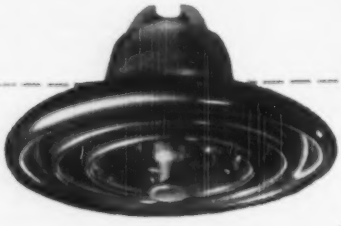
Thomas engineers pioneered the under-glaze process resulting in the radio noise-free porcelain insulator (Patent No. 2154387). Service records*, line and laboratory tests prove the superiority of "*Quiet-Types*" over conventional insulators.

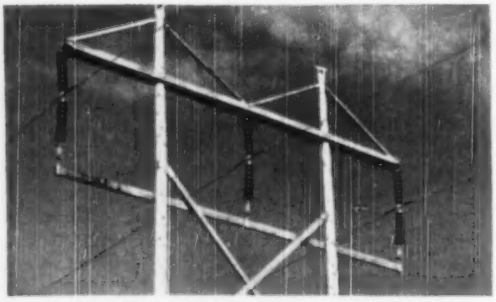
After all is said . . . it's still quality that counts plus proper designing, precision manufacturing . . . and PROOF OF PERFORMANCE. Since the beginning of the Electrical Industry, Thomas has been supplying porcelain for the most difficult insulation problems. Why gamble?

*Available upon request.

SPECIFY THOMAS INSULATORS—THE BEST BY LINE TEST

— Since 1873 —





230-kv hold-down structure designed by the Engineering and Planning department of Idaho Power Company.

The R. Thomas and Sons Co.

LISBON, OHIO

NEW YORK CHICAGO

Sales Representatives: E. B. Anderson Co., *Detroit* • Paul Berry, *Oklahoma City* • Ken H. Bost, *Seattle* • Butler & Land, *Dallas* • Hugo Sales Company, *Minneapolis* • R. E. Cunningham & Son, *Los Angeles* • Electric Supply Co., *Albuquerque* • Engineer Sales Corp., *St. Petersburg* • R. F. Hamilton & Associates, *Denver* • Geo. E. Honn Company, *San Francisco* • Leiser & Company, *Philadelphia* • Lynn Elliott Company, *Houston* • John O. Pettijohn Company, *Knoxville* • Redmond Supply Co., *Phoenix* • J. F. Schaefer & Co., *Kansas City* • R. J. Sullivan & Company, *Boston* • E. E. Torkell, *Memphis* • Triangle Electric Supply Company, *El Paso* • Joe Williams, *Little Rock* • *Representatives in other principal cities*

KEEP METAL SURFACES AND CONTACTS *CORROSION FREE* WITH NO-OX-ID "A SPECIAL"

It's a simple matter to eliminate formation of oxides, sulphides and other corrosion deposits on metal surfaces and contacts. Just coat the part with NO-OX-ID "A Special" . . . the Dearborn rust preventive of a hundred uses in the utility field.

NO-OX-ID "A Special" is a heavy duty, chemically inhibited compound recommended by manufacturers to provide trouble-free joint connections . . . impervious to weather, corrosive fumes, high humidities, water immersion. It is economical to use, easy to apply, easy to remove.

Check the advantages of NO-OX-ID "A Special." Put it to profitable use in your shops . . . on maintenance and repair trucks. Mail the coupon for further, helpful information.

DEARBORN CHEMICAL COMPANY

General Offices: 310 South Michigan Avenue • Chicago 4, Illinois

USES

Bus bars	Steel conduit
Contact points	High line towers
Switch blades	Brackets
Transformers	Insulators
Aluminum cable	Wire
Connectors	Aerial cable
Clamps	Turnbuckles
Steel light poles	Manhole hardware

Dearborn
Reg. U. S. Pat. Off.
THE ORIGINAL RUST PREVENTIVE
NO – OX – ID
IRON – RUST

DEARBORN CHEMICAL COMPANY
310 S. Michigan Ave., Dept. EW
Chicago 4, Illinois

Gentlemen: Please send booklet on NO-OX-ID "A Special."

Name.....

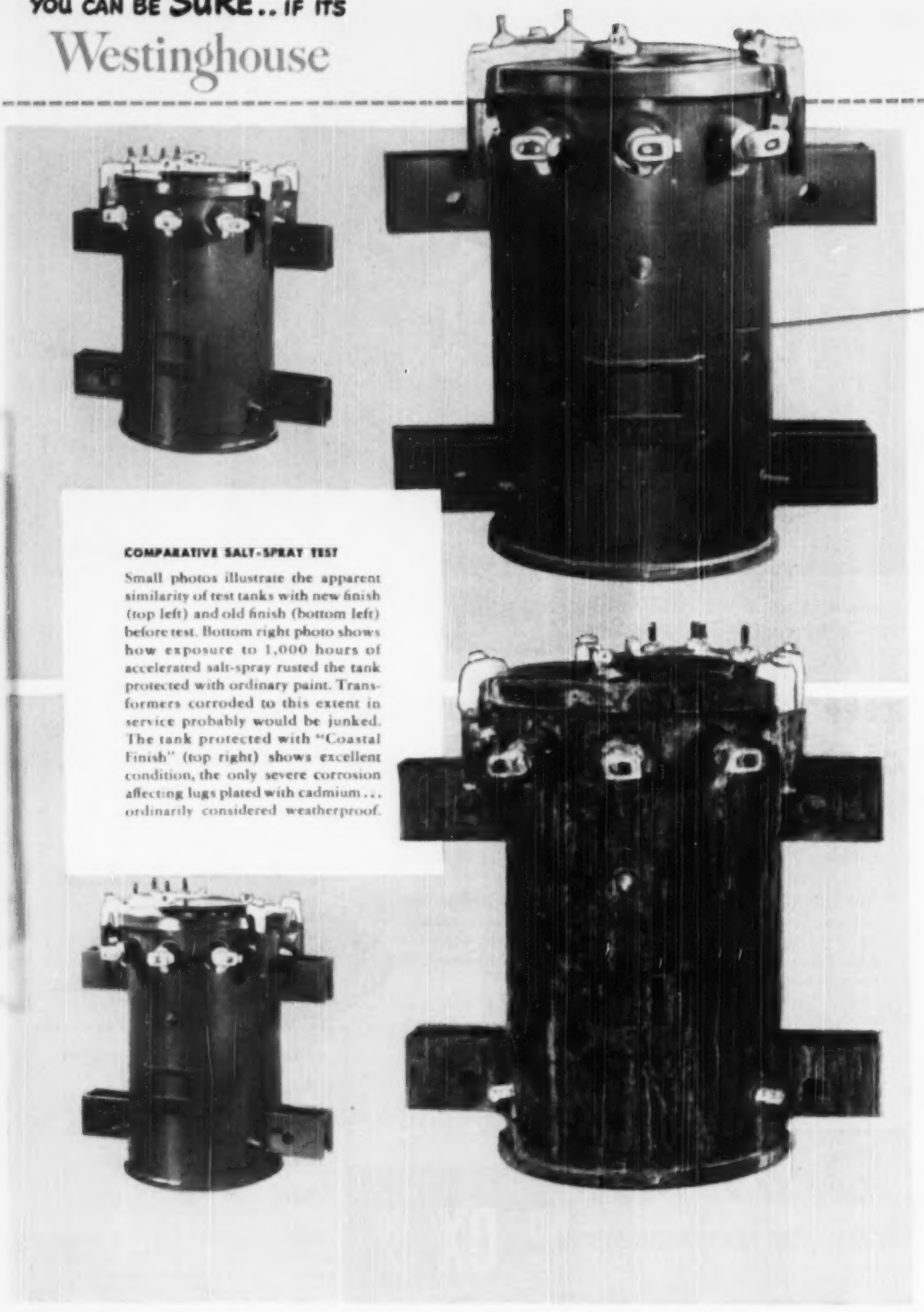
Company.....

Address.....

City.....*Zone*....*State*.....

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



COMPARATIVE SALT-SPRAY TEST

Small photos illustrate the apparent similarity of test tanks with new finish (top left) and old finish (bottom left) before test. Bottom right photo shows how exposure to 1,000 hours of accelerated salt-spray rusted the tank protected with ordinary paint. Transformers corroded to this extent in service probably would be junked. The tank protected with "Coastal Finish" (top right) shows excellent condition, the only severe corrosion affecting lugs plated with cadmium ... ordinarily considered weatherproof.

—NEW "COASTAL FINISH"

New finish for Pole-Type Transformers adds years of protection under all service conditions

Greater resistance to chalking, cracking and rust! More than doubles the protective life of the finish! Adds years of service before repairing and repainting!

A new and better finish, developed in Westinghouse laboratories specifically to meet severe conditions of blistering heat, icy cold, rain, snow, salt and other corrosive atmospheres, *"Coastal Finish"* is now provided on all Westinghouse Distribution Transformers, "CSP"® and conventional.

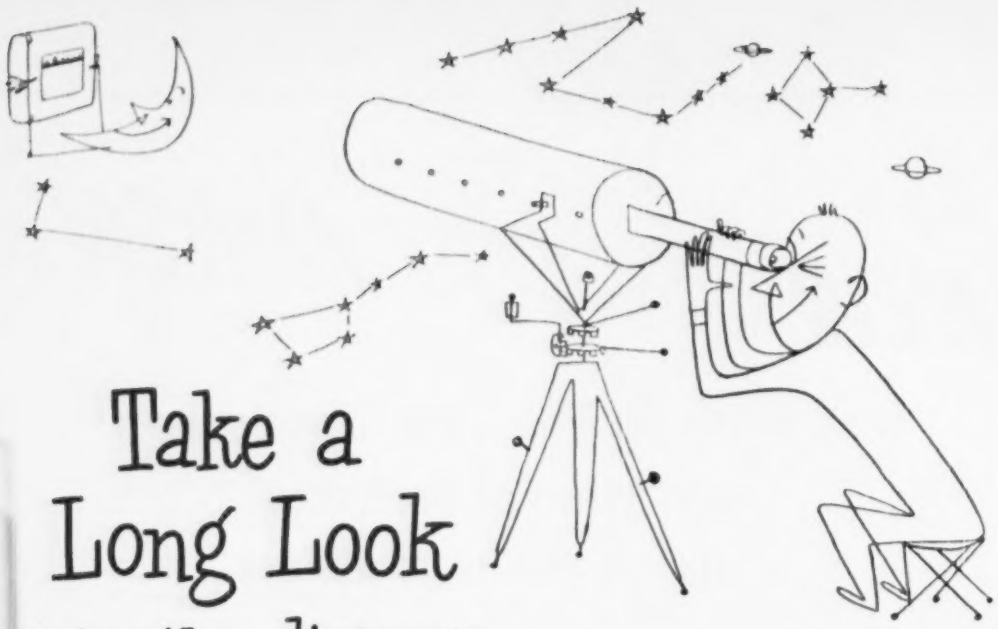
"Coastal Finish" consists of a primer coat to inhibit rust, an intermediate coat containing mica flakes that overlap like shingles on a roof to provide superior moisture resistance, and a final gloss coat that improves appearance, and filters out ultra-violet sun rays. Infra-red baking assures complete hardening of each paint film.

Comparative weathering tests . . . salt-spray, acid and alkali resistance, and weather-o-meter . . . clearly show the advantage of *"Coastal Finish"* in all types of atmospheres. This is *another plus value* in Westinghouse Distribution Transformers. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-70576

Westinghouse

DISTRIBUTION TRANSFORMERS



Take a Long Look into the distance

and see the facts you need for high efficiency

Bristol's Metameter System of Telemetering gives an accurate, up-to-the-minute account of conditions at remote points . . . enables you to anticipate abnormalities . . . prevent emergencies.

Bristol Strip-Chart Metameter Receiver

Used by load dispatchers of central station systems for readings of:

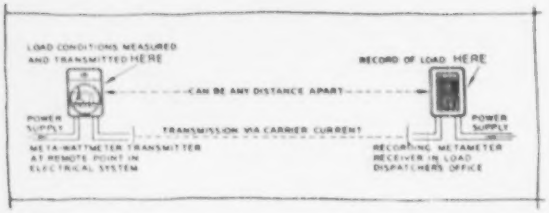
- load at each tie-line point
- output of each generating station
- totalized output (on a single instrument) of all generating stations
- active and reactive power and power demand at key points
- voltage and current at various points

And by operators of generating stations for readings of:

- output of each associated station —attended or unattended
- total output of generating station
- water level and waterwheel gate position
- water level—reservoirs, surge tanks, etc.

Readings can be transmitted any distance over any two-wire circuit or its equivalent—carrier-channel, telephone, telegraph or radio (including microwave) . . . to recording receivers (narrow or wide-strip chart or round chart) or indicating receivers with illuminated dials.

Write us for Bulletin M1700. THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 20, Conn.


LOAD CONDITIONS MEASURED AND TRANSMITTED HERE
RECORD OF LOAD HERE
CAN BE ANY DISTANCE APART
POWER SUPPLY
TRANSMISSION VIA CARRIER CURRENT
POWER SUPPLY
META-WATTMETER TRANSMITTER AT REMOTE POINT IN ELECTRICAL SYSTEM
RECORDING METAMETER RECEIVER IN LOAD DISPATCHER'S OFFICE

BRISTOL

Gives You the FACTS When and Where You Want Them

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

From DESIGN
TO DELIVERY
R&IE
CENTRALIZED
SUBSTATION SERVICE
Check the Facts
1 DESIGN layout, detail complete.
2 FABRICATION complete in R&IE shop.
3 GALVANIZING—new controlled methods.
4 SWITCH ASSEMBLY—From foundry and all machining operations, R&IE controls the entire manufacture ready for delivery.
5 VERSATILITY to solve any special problem. Illustration shows typical industrial application of R&IE design.
RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES
INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

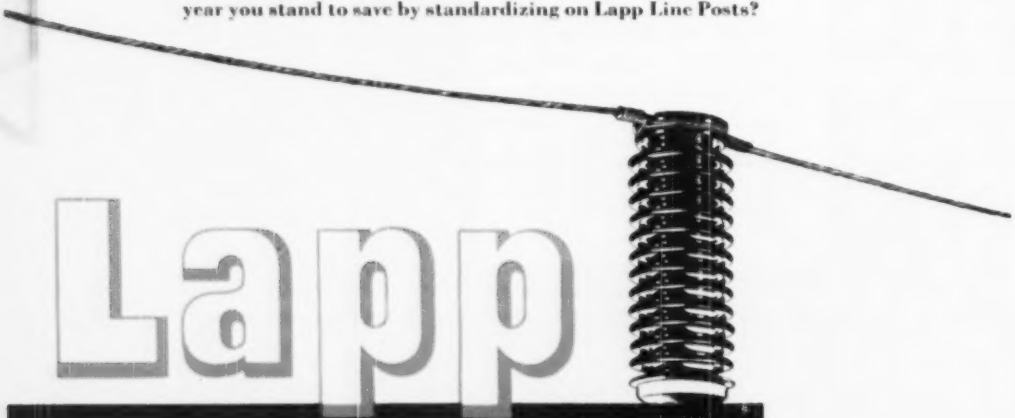
TESTING DEVICES

Why Not Shock Yourself?

● If you're like most engineers responsible for the operation of transmission lines, you've probably largely lost track in recent years of insulator performance records. It seems rather popular these days to assume that high-voltage insulators are generally "All right." So usually there's a rude shock waiting for any engineer or executive who goes to the trouble of actually finding out what the annual cost for transmission insulator maintenance in his company really adds up to. Those costs do go on, because there's little about conventional transmission insulators today that make them much better than they were 20 years ago, when practically all companies kept a sharp eye on maintenance costs.

But there's one notable exception to all this. The Lapp Line Post. This advanced insulator design now has a 19-year service record. On line after line, all across the country, it has proved its ability to cut insulator maintenance cost to a tiny fraction of that run up by pin-type insulators.

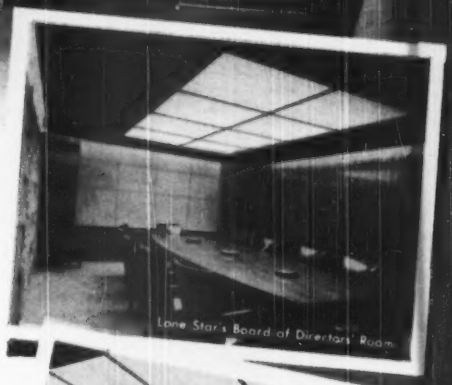
A careful analysis of your own service records will show you the facts. Isn't it worth it for the thousands of dollars per year you stand to save by standardizing on Lapp Line Posts?



Lapp

LAPP INSULATOR COMPANY INC., LEROY, NEW YORK

In Lone Star's Reception Room ten 33½" x 41" panels of white translucent PLEXIGLAS are mounted 12" below twenty 30-watt, 36" fluorescent lamps, spaced on 16" centers. Average illumination: 55 foot candles. Design and installation by The Frink Corp., Long Island City, N. Y. Architects: Kenneth H. Ripnen Inc., New York City. Lighting Consultant: E. B. Silverman, Smith & Silverman, New York City.



Lone Star's Board of Directors' Room

Lone Star's Executive Offices

Skylighted Office? No! It's a PLEXIGLAS Luminous Fixture

Man-made daylight—soft, even, glare-free—is a functional and decorative feature of Lone Star Cement Company's new offices in New York City. In nearly every room, PLEXIGLAS Luminous Ceilings diffuse light so perfectly that a *luminous environment* is created, easy on the eyes and nerves.

PLEXIGLAS simplifies the design, installation and maintenance of other lighting fixtures, too. Because this acrylic plastic is easily cut, shaped and fabricated, it adapts readily to coffer, cove or trough lighting, completely enclosed units, wall or overhead lighting of all kinds. Lightness and strength make it easy and inexpensive to ship and erect. Resistance to breakage and discoloration cuts maintenance costs to a minimum.

Get Full Details Today. Free information on PLEXIGLAS Quality Lighting for offices, homes, stores, drafting rooms, public buildings, is yours for the asking. Send for our new brochure, No. 77, "As Light as Day the PLEXIGLAS Way," and tell us about your lighting problem. The counsel of our Design and Fabrication Laboratory Staff is yours without obligation.

PLEXIGLAS *is a trade-mark, Reg. U. S. Pat. Off., and in principal foreign countries.*
Canadian Distributor: *Crystal Glass & Plastics, Ltd., 54 Duke Street, Toronto, Ontario, Canada*

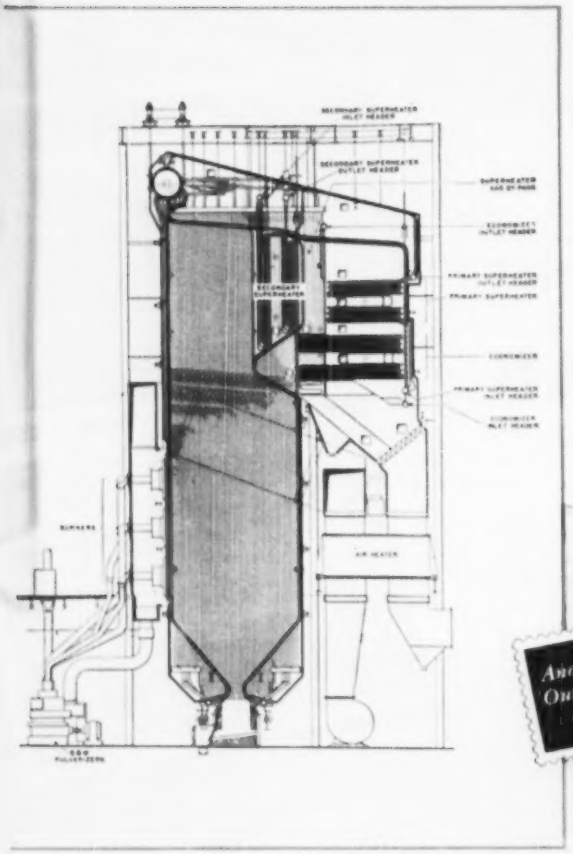
CHEM

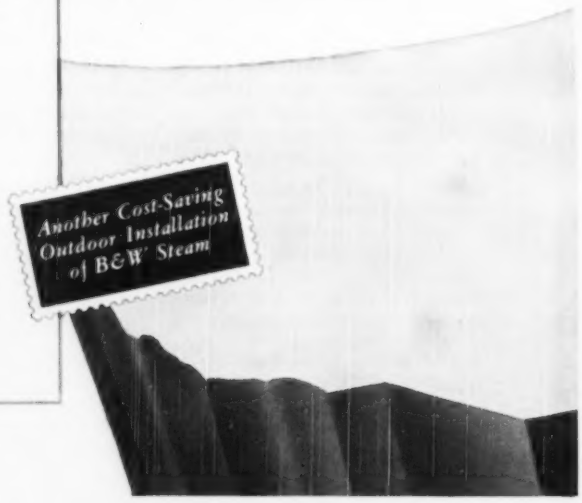
ROHM & HAAS COMPANY
WASHINGTON SQUARE, PHILADELPHIA 5, PA.
Representatives in principal foreign countries

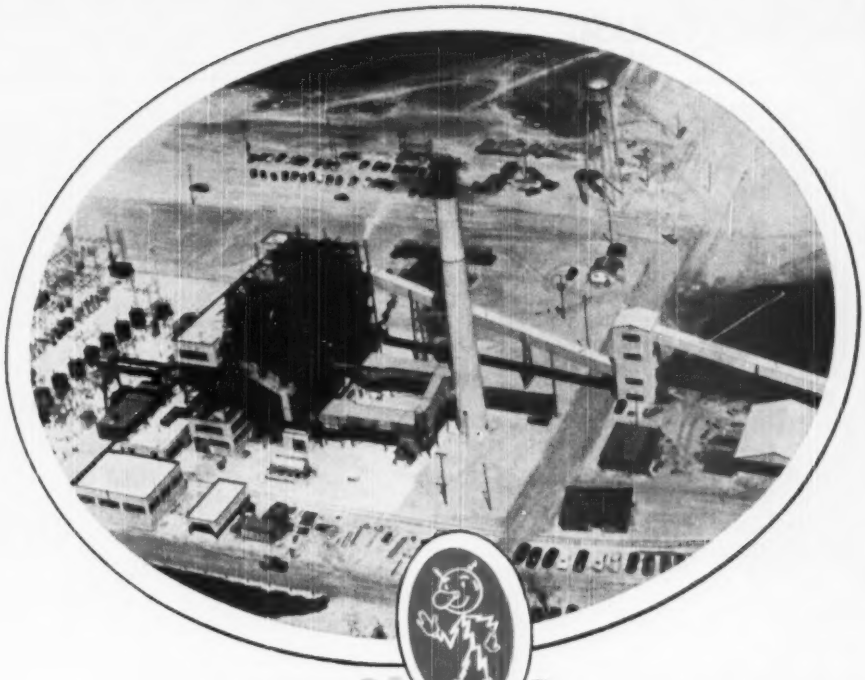
DESIGN FOR ECONOMY AT *New* LUMBERTON PLANT

A fine example of how B&W engineering meets specialized requirements of modern central stations is the new 88,000 kw Lumberton (N. C.) Plant of Carolina Power and Light Company. Here, two 425,000 lb. per hr. Radiant Boilers provide multiple-fuel flexibility and extended range of final steam temperature control — from full load down to less than 1/3 capacity at 1350 psi, 955 F. Further, the boilers are located entirely out of doors, at considerable saving in first-cost. It's this ability to meet, and even anticipate, unusual steam-generating requirements that has won leadership for B&W boilers and related equipment . . . notably in such recent trends as pressurized operation, cyclone furnace firing, reheat, gas recirculation, improved materials and construction methods for service at higher pressures and temperatures, greater purification of steam and condensate, and in lower maintenance of boilers and pulverizers.

Perhaps a creative *research* approach to *your* boiler problems is indicated by today's high costs. It's the sort of approach that has been a B&W tradition for more than 80 years. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.







Aerial view of Lumberton Steam-Electric Plant showing outdoor installation of two B&W Radiant Boilers. Designers and construction supervisors: Ebasco Services, Inc.

Helping Industry Cut Steam Costs Since 1867

BABCOCK & WILCOX

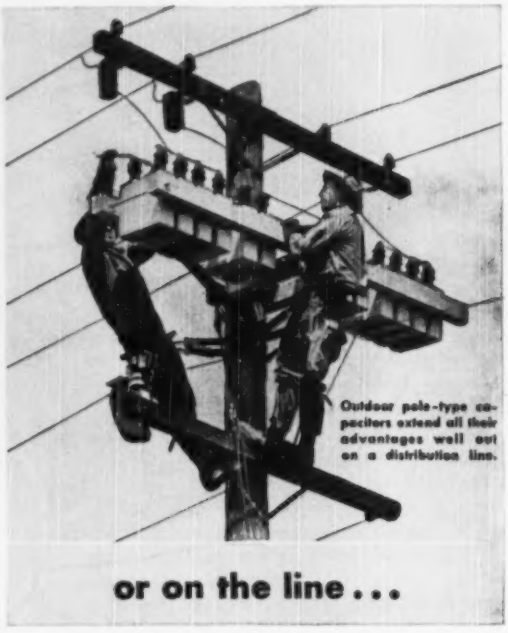
G-483-TR

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

Three 900-kvar equipments, three-phase-connected and automatically switched in three steps in response to voltage level.

At the substation . . .



Outdoor pole-type capacitors extend all their advantages well out on a distribution line.

or on the line . . .

Make way for the Payload!

Capacitors provide the lowest-cost method of gaining extra circuit capacity . . . and now cost less than ever before . . . in some ratings as low as $3.60 per kvar. So, *now* is the time to make way for the payload . . . to release wasted circuit capacity for more kilowatts. And in the complete line of Westinghouse Inerteen Capacitors, you'll find the right equipment for the job.

From individual unit installations on primary distribution lines, to completely housed equipments for substation banks you can be *sure* of better performance with Westinghouse Capacitors—whether the application be power-factor correction, voltage control or reducing line and equipment losses. But, for any application, check first with Westinghouse.

Our years of close co-operation with utilities have given us broad experience in applying capacitors to many conditions. We'd like to apply it to your problem.

For complete information call your local Westinghouse office, or write for Booklet B-4343. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-60717

GET THESE TIME-PROVED FEATURES

- **Inertex Insulating Paper**
- **Inerteen Impregnation**
- **Solder-Sealed Porcelain Bushings**
- **Durable, All-Welded Steel Cases**
- **Weatherproof Zinc-Spray Finish**

Westinghouse

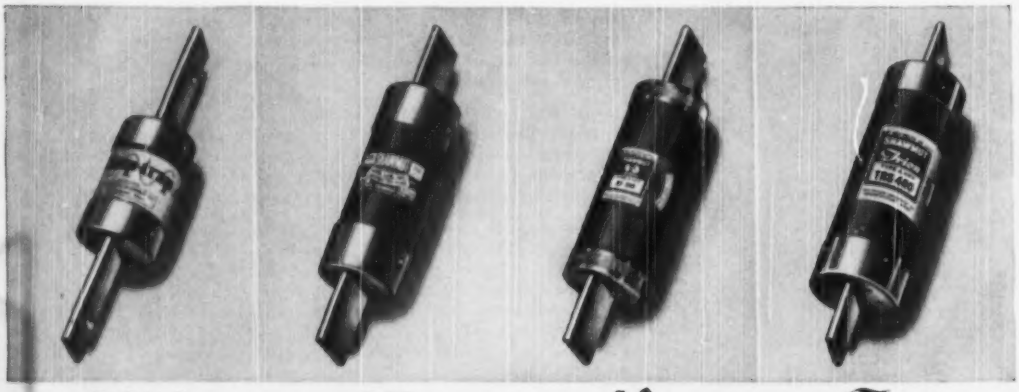
CAPACITORS

Tirex Cables
Can Take It!!
NAME YOUR HAZARDS; the hazards that time and again raise havoc with the portable cords and cables you depend upon for the efficient operation of vital electric equipment.
Water, snow and mud as pictured here; dragging over rough surfaces and pulling around sharp bends; runovers by heavy mobile equipment; grease, oil, chemicals, sunlight, heat and flame —a few, perhaps all of these cable enemies are writing "down time" into the performance records of your equipment.
You can beat the problem, simply, economically, by specifying Simplex-TIREX Cords and Cables when you next order. The TIREX line is performance proved — proved in the field under the most severe conditions during more than a quarter-century of service to all industries. It includes cords and cables that meet the requirements of all portable electric apparatus. All are jacketed with cured-in-lead Selenium Neoprene Armor, the toughest, most-reliable protection available for portable cords and cables.
If you would like complete information write us today for a TIREX Catalog, specifying the voltage range you are principally interested in.
SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

MICRO SECONDS TO HOURS...

DC or AC . . . up to 200,000 amperes interrupting capacity!

Who else or what else can offer this scope of CIRCUIT-MATCHED electrical protection for circuits 600 volts or less?

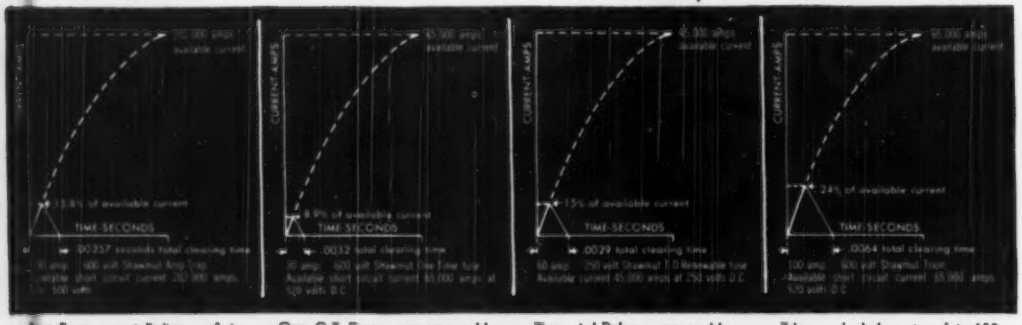


Amp-trap *. . . super fast*

ONE O-T TIME *. . . fast*

Time t-d *Renewable . . . time delay*

Trion *. . . super time delay*



Amp-Trap current limiter — 1 to 4000 amps.

Protects: Branch circuits, feeders, cables, bus ducts, against very heavy short circuits up to 200,000 amps interrupting capacity.

SEND FOR AMP-TRAP BULLETIN

One O-T Time — non-renewable — 1 to 600 amps.

Protects: Branch circuits and feeders against overload and moderate short circuits.

SEND FOR BULLETINS 501 and 502.

Time t-d Delay — renewable — 1 to 600 amps.

Protects: Branch circuits and feeders against overload and moderate short circuits. Has built-in time delay on overload.

SEND FOR BULLETIN 500.

Trion — dual element — 1 to 600 amps.

Protects: Branch circuits, feeders and motors against overload, overheating, single phasing and heavy short circuits.

SEND FOR BULLETIN 506.

THE CHASE-SHAWMUT COMPANY
370 Merrimac St., Newburyport, Massachusetts

SHAWMUT Circuit-Matched FUSES

Insure more accurately engineered protection for any circuit

SINCE 1893

The most complete line of circuit protection devices

Pole Star Sales are UP

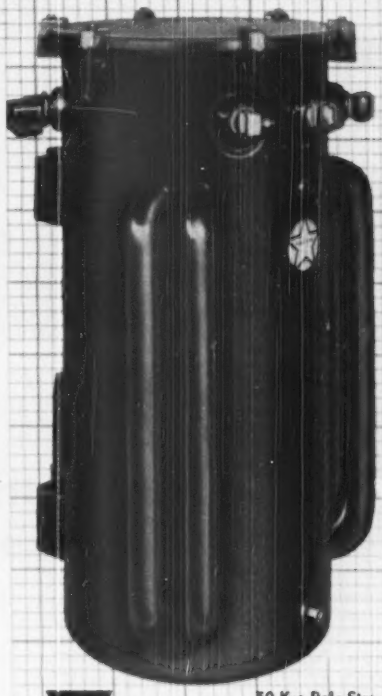
Each month a greater number of Utilities and Industrials are specifying Pole Star transformers. Here are some of the reasons:

THE COIL Coils are wound independently of the core. This permits each coil to be *tightly* wound and *individually* treated for great mechanical strength. If necessary, the coil can be removed from the core and easily replaced *in the field* without appreciably changing the core loss or exciting current of the core.

THE CORE *Low Exciting Current* is one of the outstanding features of the Pole Star core. Laminations of the cold rolled oriented steel core are *individually lapped*. The large cross section area at the lap reduces the density and prevents a concentration of flux. The lapped construction also results in a quiet core — *the noise level is fixed* at a low value.

THE TANK Three coats of transformer paint are applied and baked onto the tank, only after the surface of the tank is thoroughly *shot blasted*. Hanger lugs are hand welded to the tank with a complete bead weld *to prevent* any water from lodging beneath the hanger brackets. Tanks are sealed with synthetic rubber gaskets.

THE BUSHINGS There are no pockets or gooseneck bushings on the Pole Star. All side-issuing bushings, 5 Kv and below, are straight, stud type. Bushings are *lathe-turned* for greatest mechanical strength. Bakelite insulating caps cover the high voltage solderless connectors and swing out of the way when line connections are made. Forged terminal connectors are designed so the lineman *can see the connection* while he is making it.



50 Kva Pole Star
2400-120 240 volts

For more complete information write for:
Pole Star Catalog No. 349, 3 Kva through 25 Kva.
Pole Star Catalog No. 1049, 37½ Kva through 100 Kva.

Pennsylvania
TRANSFORMER COMPANY
CANONSBURG, PA. *Greater Pittsburgh District*

P.S.
Let the POLE STAR be your guide

Product Of Long Experience — Safe Thrifty And Reliable

Service Restored

faster than ever after ice storm . . .

Ice storms are a utility's nightmare. Recently, the Missouri Public Service Corporation had a beauty on its hands. Driven by high velocity winds, heavy sleet lashed trees and roads, coated them with 6 to 8 inches of ice, pulled down hundreds of miles of line in the 17-county service area.

Thanks to *instant communication* made possible by General Electric 2-way radio in line trucks and supervisors' cars, service was restored at least 3 to 4 days earlier than would have been possible without the use of radio, according to officials at company headquarters in Warrensburg.

Utilities in every state use G-E 2-way radio to coordinate planned interruptions, to save manhours, truck hours, time on outages. Let our engineers study your communication problem, too—there's no obligation. Write: *General Electric Company, Section 19110-20, Electronics Park, Syracuse, New York.*

YOU BE THE JUDGE — CHECK THESE ADVANTAGES

Equipment Features	General Electric	Manufacturer A	Manufacturer B
Triple-Tuned Transformers (high selectivity with fewer tubes)	Yes	No	No
At Least 2 Watts Peak Audio Output	Yes	No	No
Instantaneous Modulation Limiting	Yes	Yes	No
Number of Tubes	18	26	22
Cost per Set of Tubes	$24.50	$50.16	$31.79
Spurious Radiation at any frequency	65 db	60 db in the band only	60 db
Cable Junction Box	Not Required	Required	Not Required
Key Lock for Protection of Every Unit	Yes	Optional at Extra Cost	Not Available
Microphone Quick Release Plug	Yes	Not Available	Not Available
20 kc & 40 kc Receiver Selectivity	Yes	No	No
Two-Unit Design for Maximum Mounting Flexibility	Yes	No	No

You can put your confidence in—

GENERAL ELECTRIC

word is spreading

about Foster Wheeler Dual Circulation Steam Generators

The first of a group of Foster Wheeler Dual Circulation Steam Generators was placed in service in May 1948 at a large midwestern refinery. It has been in successful operation ever since and has proved its ability to produce steam of much greater purity than has been hitherto attainable in a boiler of conventional circulation.

Evidence of the increasing acceptance of the Foster Wheeler Dual Circulation Steam Generator is demonstrated by recent additional orders from both the utility and refinery industries.

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N.Y.

Write for a copy of Bulletin B-50-11 which covers the principles and advantages of Dual Circulation.

FOSTER WHEELER

READY FOR YOU! Standard's
TRADE MARK ®
FOR OWNERS AND

A complete line of transformers for every class of service
Standard
transformers
. . . on the job
STANDARD TRANSFORMER
WARREN . . . OHIO

THE STANDARD TRANSFORMER CO.
WARREN, OHIO • • OFFICES IN PRINCIPAL CITIES

NEW INSTALLATION BOOKLET

BUYERS OF TRANSFORMERS

• • • ★ **SHOWS THE STANDARD TRANSFORMER COMPANY TRANSFORMERS "ON THE JOB" ALL OVER THE WORLD**

• • • ★ **TELLS HOW THE STANDARD TRANSFORMER COMPANY HELPS DISTRIBUTE POWER IN THE NORTH, EAST, SOUTH AND WEST**

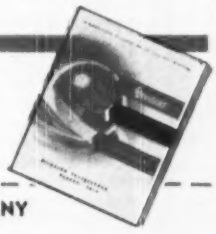
● Now you can read the story of how The Standard Transformer Company has influenced the distribution of electrical power. You'll like the dynamic part this Company is playing in these advances. See the illustrated sections in this 20-page booklet devoted to STANDARD transformers operating in industry, utilities, rural electrification and many other interesting subjects, too. Also listed are 253 impressive installations of STANDARD transformers.

Get up-to-date by reading about electrical developments in this new brochure. Order your copy now. We'll see that you receive one promptly upon receipt of the coupon below.

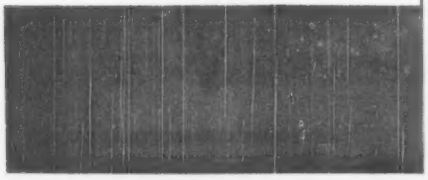
TRANSFORMERS FOR EVERY CLASS OF SERVICE

For a complete description of the design and construction used in the manufacture of each type of transformer, write for the bulletins listed.

Askarel Cooled Transformers	No. S-101
Dry Type Transformers	No. S-202
Rural Transformers	No. S-301
Distribution Transformers	No. S-401
Power Transformers	No. S-402
Current and Potential Transformers	No. S-501
Type NAS Current Transformers	No. S-502
Testing Transformers	No. S-601
Street Lighting Transformers	No. S-701



20 PAGES
30 ILLUSTRATIONS
253 TRANSFORMER INSTALLATIONS



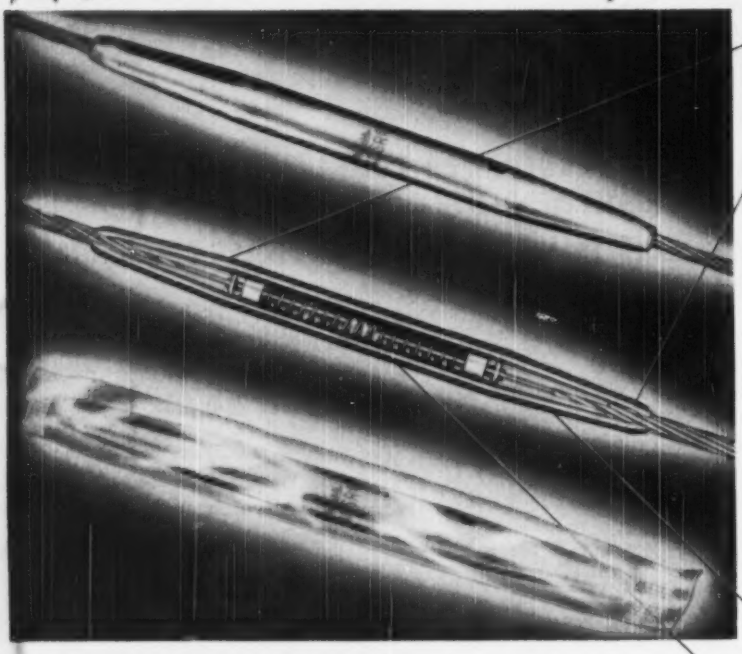
MAIL THIS COUPON AND GET YOUR COPY OF THIS NEW BOOKLET TODAY!

THE STANDARD TRANSFORMER COMPANY
WARREN, OHIO

Please send me my copy of your new Installation Brochure titled, "Standard Transformers . . . on the job." Send it to:

YOUR NAME_____
TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE____ STATE_____

Accents on Accuracy



in the manufacture of

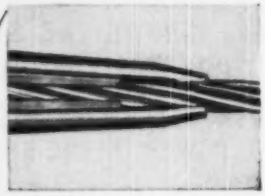
THE NEW, TOUGH, DEPENDABLE
ACSR STRAIGHTLINE SPLICE

FAST, POSITIVE ASSEMBLY • NO TOOLS NEEDED FOR INSTALLATION ON ACSR CONDUCTOR • DEVELOPS RATED TENSILE STRENGTH • HARDENED STEEL-GRIP TEETH • TENSION-SET JAWS

Reliable sizes №2 and №4 ACSR Straightline splices are now available from stock. In both sizes there are types to provide for 7/1 and 6/1 strand. Outer tube of hardened aluminum alloy. Fast assembly to steel core and conductor: core is bared 3" to 3¼"; jaw permits passage of core wire beyond point where jaws engage aluminum strand, assuring proper positioning for full core-gripping area of jaws. Strand will not enter splice until core wire is properly positioned. Jaws are set on core and strand by applied tension. Splices are packed with corrosion- and weather-resisting neutral grease and enclosed in individual double cellophane envelopes. Plain instructions for proper use are enclosed with each splice.

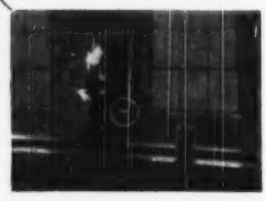
Splice is provided with release slots.

1. 648 Zinolyte plated steel teeth grip the wire firmly, but without gashing. Strand fits to jaw shoulder, assuring proper positioning.



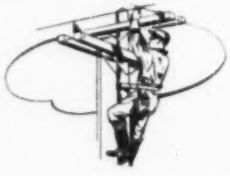
2. Tube ends are accurately designed to prevent insertion of burred or misshapen wires. Design guides strands to their proper position.

3. Rigid tensile tests of ACSR and splice assembly reveal holding strength in excess of rated tensile of ACSR.



4. Vibration tests check dependability under various degrees of tension.

Conclusive test data available on request.



Reliable ELECTRIC COMPANY

3145 CARROLL AVENUE, CHICAGO 12, ILLINOIS

OVER 40 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS
AND
CONSTRUCTION SPECIALTIES

YOU CAN BE SURE.. IF IT'S
Westinghouse

ONE WEAK LINK
in your high-voltage motor control
CAN BE COSTLY

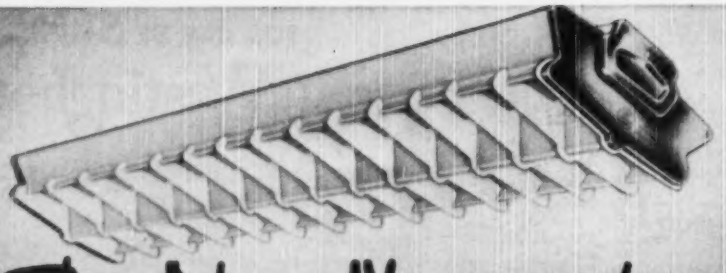
2300-4800 voltage systems pack a punch! It takes more than just a starter for *safe* control of motors connected to these systems.

What's the answer? The three-way co-ordinated protection of Westinghouse Combination High-Voltage Starters. They combine high interrupting capacity with motor and personnel protection—in one unit. Contactors and fuses, as well as all other components, are designed for each other . . . made to work together . . . balanced for the best results.

Each link of this three-way protection is of equal importance. You get positive fault protection with type BAL fuses. Heavy-duty contactors—either oil-immersed or air-break type—guard the motor. Sectionalized cabinets offer protection for personnel.

Ask your Westinghouse salesman to give you full details and a copy of "Co-ordinated Protection", booklet B-4673. Or, write directly to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-27003

Westinghouse
HIGH VOLTAGE STARTERS



The New "Lenox Look"

FOR STORE LIGHTING

NOW! LUMINOUS PLASTIC SIDES!

Good looking? You've never seen such style and beauty in a fluorescent store lighting fixture before! The smartly designed "Lenox" series, now available with extruded plastic side panels, retains all its high efficiency and low brightness ratios—and adds soft, diffused side lighting to enhance its elegant appearance. The "Lenox"—for two or four 40-watt lamps—surface or suspension mounting—continuous or unit installations.

ACCENT UNITS

Adjustable or fixed accent units available for inclusion in "Lenox" runs or at the ends of runs.

and the Usual Day-Brite Premium Quality

...WITHOUT PREMIUM COST!

The "Lenox," like all Day-Brite fixtures, gives you *extra value*—example: interlocked louvers for extreme strength and rigidity; example: NO-BLINK type starters; example: HOT-BONDED SUPER WHITE enamel finish.

These and the many other famous Day-Brite top-quality features are standard equipment—*at standard prices*. Dollar for dollar, you can't equal Day-Brite's long-term, trouble-free performance at the lowest possible installation, maintenance and operating cost.

Write today for the complete "Lenox" story. Address: Day-Brite Lighting, Inc., 5425 Bulwer Ave., St. Louis 7, Mo. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

036

"DECIDEDLY BETTER"

DAY-BRITE

Lighting Fixtures

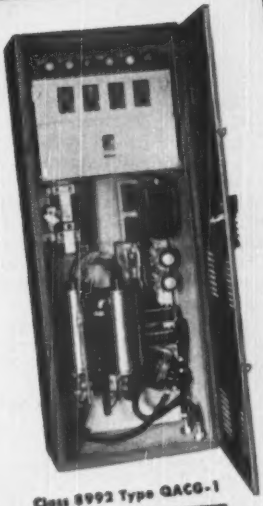
DISTRIBUTED NATIONALLY BY LEADING ELECTRICAL WHOLESALERS

SQUARE D *Electronic* WELDER CONTROL REDUCES PRODUCTION COSTS!

Production cost was a vital factor when Nash tooled to mass-produce its new Rambler series cars. Gun welders were equipped with Square D electronic controls to meet four important objectives—continuous production, consistent results, high speed, reduced maintenance cost.

Square D's industrial construction assures simpler inspection and maintenance. Firing of power tubes is synchronized to minimize transients and ease the stress on welder transformer windings. Substantially more speed is available than is normally required for body assembly welding.

Write for Class 8992 Bulletin 214. Square D Company, 4041 N. Richards Street, Milwaukee 12, Wis.



Class 8992 Type QACG-1

Combination NEMA 3B timer, electronic contactor and 225 ampere circuit breaker.

SQUARE D COMPANY

DETROIT · MILWAUKEE · LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

For

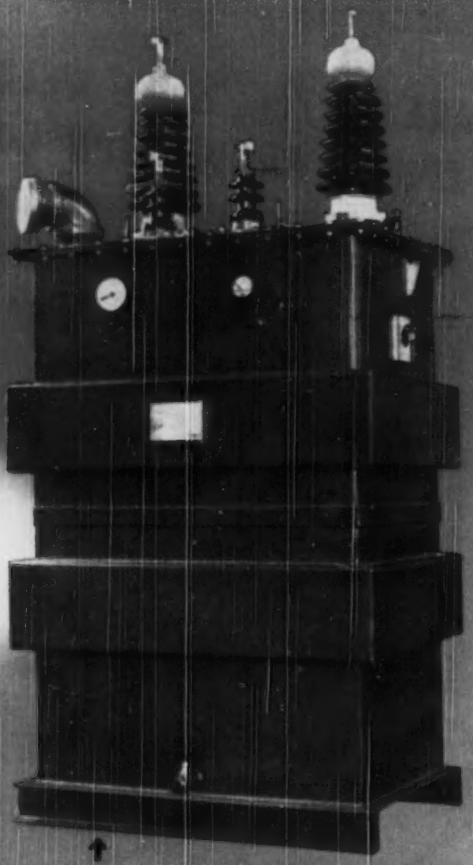
High Voltage Circuits

Uptegraff DISTRIBUTION TRANSFORMERS

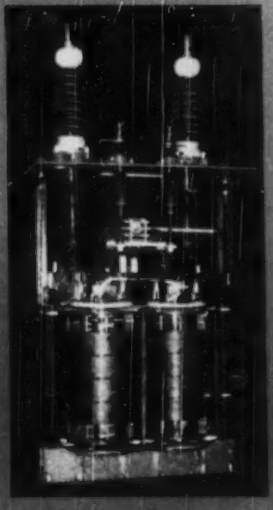
Built for operation up to 115,000 volts, Uptegraff High-Voltage Distribution Transformers are designed to meet all conditions encountered in this service. Insulation design is fully coordinated for all recognized operating conditions. In these designs, the same even distribution of potentials has been achieved as in lower voltage transformers, by avoiding corona and points of high dielectric stress. Long life and continuous service are provided for by the elimination of insulation "hot spots."

Uptegraff High Voltage Transformers are vacuum-filled, to prevent air inclusions. They conform with NEMA and ASSA standards.

Prompt deliveries can be arranged.



333 KVA Uptegraff Distribution Transformer, self-insulated, self-cooled. 66000—7200/12470 Y volts.



Core and Coil assembly, as seen from the low voltage side.

Uptegraff TRANSFORMERS

POWER · DISTRIBUTION · INSTRUMENT SPECIALTY

R. E. UPTEGRAFF MANUFACTURING CO.

SCOTTDALE, PENNA.

Amcreco
Lowry Process
Creosoted
Products
43
35
Amcreco
Branded Poles
. . are full-length pressure treated
to last longer with less maintenance
The story behind the long life of Amcreco poles is a story of superior treating methods. Amcreco methods of wood preservation are accepted methods, improved by years of practical experience, research and development. Evidence of the long-lasting qualities of Amcreco poles is present on every pole. It's the Amcreco Brand which shows the year the pole was treated . . . signifying that these poles are not ashamed of their age. Why not get the complete Amcreco story today.
AMERICAN CREOSOTING COMPANY
INCORPORATED
COLONIAL CREOSOTING COMPANY
GEORGIA CREOSOTING COMPANY
ADDRESS INQUIRIES TO CHICAGO, ILL., OR LOUISVILLE, KY.
POLES
CONDUIT
PLANKING
CROSSARMS
Pressure treated for strength that lasts!

No. 1 ~ a statement

★ *The following statement appears in the forepart of our Catalog:*

"The history of the Hi-Voltage Equipment Company is one of devotion to an ideal —an ideal that we will use all our craftsmanship and inventive genius to produce equipment of outstanding merit. Expense is not a primary consideration in creating Hi-Voltage switches and protective equipment. You can rest assured that each switch is designed for those who want the utmost in operating dependability."

Every illustration on these pages is evidence that we have adhered staunchly to our fundamental policy.

Because substation and switching stations seldom follow any particular pattern, the dependable Switch Manufacturer must offer many different and proved designs. The most practical and economical arrangement of bus work and connections to circuit breakers, transformers, etc., dictates the varying designs of Hi-Voltage Switches.

But . . . despite any variation in design . . . everyone of these Hi-Voltage Switches:

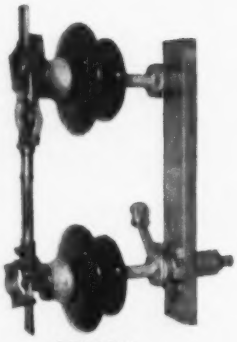
1—Has the exclusive line-type, self-aligning and self-cleaning contacts. Tests show that the life of these contacts is beyond 100,000 operations.

2—Reduces installation costs. The complete operating mechanism is machined at the Factory. No field drilling or cutting is required. The work done at the Factory saves hours for the construction crew.

Future advertisements in this series will discuss the merits of each type of Hi-Voltage Switch. In the meantime, let your Joslyn Representative give you the whole story.

● HOOK-OPERATED SWITCHES
7,500—115,000 VOLTS
400—2000 Amperes

● TYPE A-W
7,500—46,000 Volts
400—1200 Amperes



● TYPE D-N
Side-Opening Switch
7,500—161,000 Volts
600—1200 Amperes

HI-VOLTAGE

# of Hi-Voltage policy

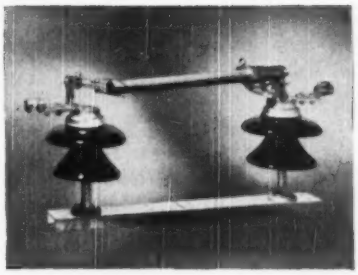
● TYPE D-C-U
Center-Break Switch
7,500—161,000 Volts
400—1200 Amperes

AVAILABLE!
200 to 3000 Amperes
7500 to 161,000 Volts
Upright, underhung or vertical mounting

● TILTING INSULATOR SWITCH
7,500—34,500 Volts
200—600 Amperes

● TYPES C-W & L-W
7,500—161,000 Volts
600—3000 Amperes

● Hi-Voltage FUSES
Up to 69 kv. Available in all types of mounting up to 35,000 amperes rupturing capacity.



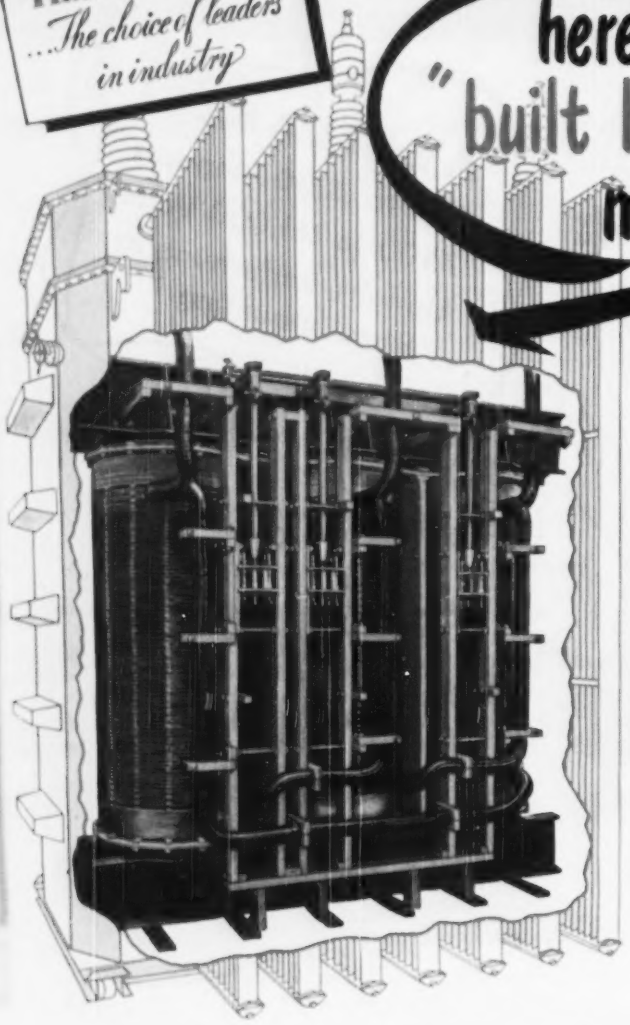
ALSO AVAILABLE!
Grounding Switches
Manual and Automatic Control Mechanisms
Mechanical Interlocks
Cross-arms and Mounting Frames
And all customary accessories

EQUIPMENT COMPANY

4000 EAST 116th STREET • CLEVELAND 5, OHIO

WAGNER TRANSFORMERS
...The choice of leaders in industry

here's what "built by Wagner" means



Wagner Power Transformers have a reputation for Quality—established through sixty years of service to the power industry. Constant improvements in materials and shop practices—meticulous attention to even the smallest details of construction—rigid maintenance of quality controls—have made Wagner Power Transformers "the choice of leaders in industry." Wagner Transformers give years of uninterrupted service because of features like these:

The coils, wound with cable paper insulated conductor, are carefully insulated from each other, and are surrounded by liberal oil ducts. Coils adjacent to the line ends have extra turn insulation and additional coil-to-coil insulation to absorb the impact of high voltage line disturbances. Coil stack assemblies have locked-in insulating spacers placed radially around the coils to maintain the oil ducts. The coil stacks are vacuum-dried, then securely fastened between heavy steel end clamps and the endplate assembly, bracing the structure to withstand short circuit conditions. All outgoing leads are heavily insulated to prevent any possibility of breakdown. All leads are mechanically held in place to maintain proper electrical clearance at all times and under all conditions of operation. Snap-acting tap changers are gang operated from outside the transformer tank by means of a shaft brought out through the tank wall.

The complete story of Wagner Power Transformer construction is told in Bulletin TU-181. Write for your copy.

Wagner maintains thirty-one branch offices, located in principal cities, for quick, convenient engineering service and consultation. Consult the nearest branch for competent advice on your next transformer installation.

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

TU-181

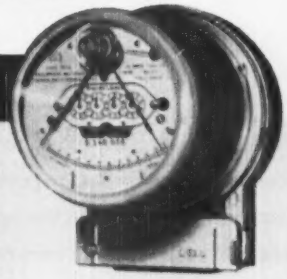
DUNCAN *Measure Demands THERMALLY!*

THERMAL DEMAND METERS

- Dependable.
- Accurate.
- Low Maintenance.
- Silicone-Damped Maximum Pointer.
- All Adjustments Accessible from Front.
- Rugged, High Torque Bimetallic Actuating Element.
- Economical Overall Cost.

As the demand gets LARGER...

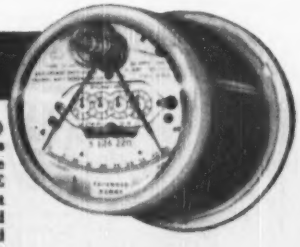
Duncan Singlephase Thermal Meters—built as either separate thermal or combination watthour-thermal demand meters—A or S base—2½, 5, 15, 50 ampere.



TYPE TF-A

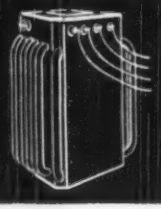
. . . . and LARGER . . .

Up to 48 KW (200 Amp.) singlephase continuous load metered with the Duncan Type TF-5E 50 ampere 240 volt combination extended range watthour and thermal demand meter, installed in Duncan H.D. Device.

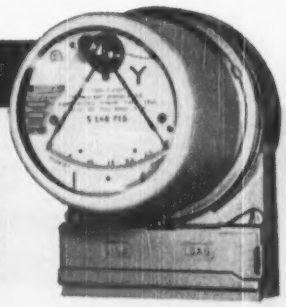


TYPE TF-5E

. . . . and still LARGER



Duncan Polyphase Thermal Meters in ratings for 2- or 3-phase 3-wire, 3-phase 4-wire wye, and 3-phase 4-wire delta metering—separate thermal meters—5, 15, and 50 ampere.



TYPE T-2½ PT

There's a **Duncan** *Thermal Demand Meter . . .*

. . . for the Job!

DUNCAN ELECTRIC MANUFACTURING COMPANY

LAFAYETTE **INDIANA**

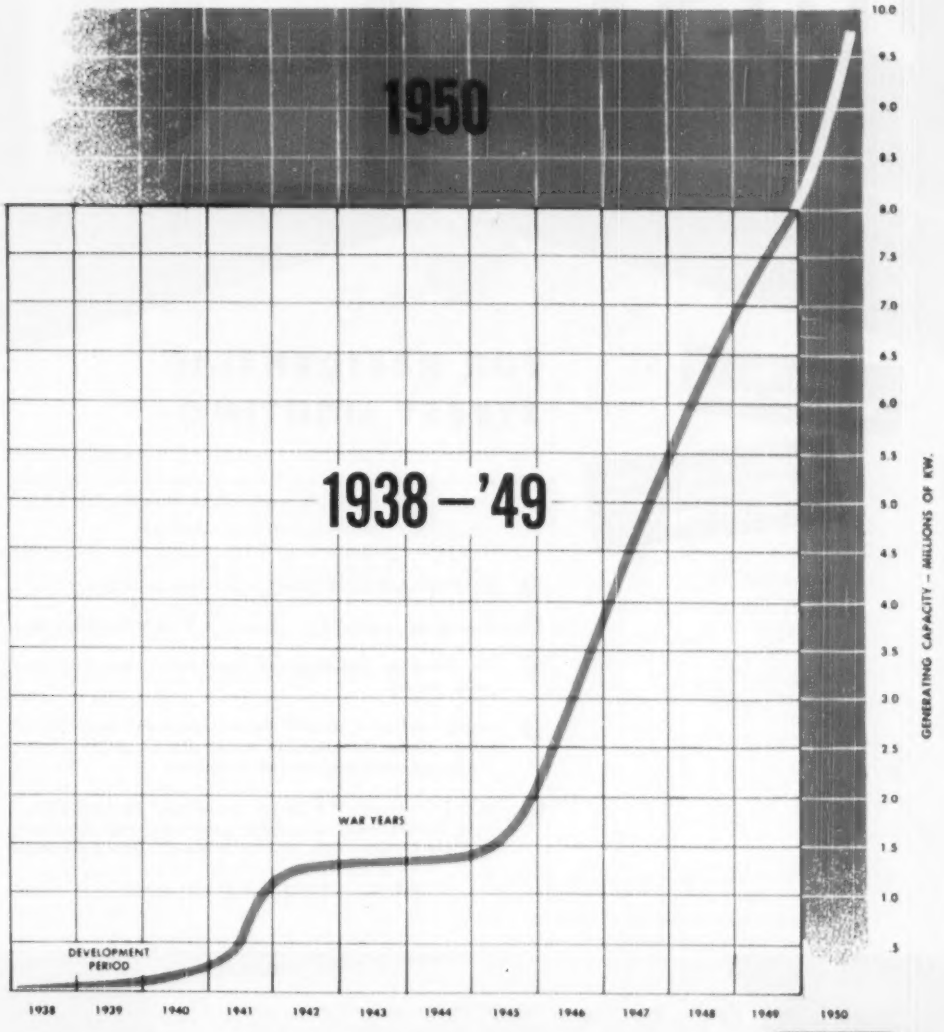
C-E Tilting Burners... more and for firing large boilers

The advertisement below, published in the fall of 1949, charted the remarkable postwar acceptance of the C-E Tilting Tangential Burner. On the opposite page the chart is reproduced and the curve extended to cover the period through September 1950. The record speaks for itself.

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

more the "Preferred Standard"



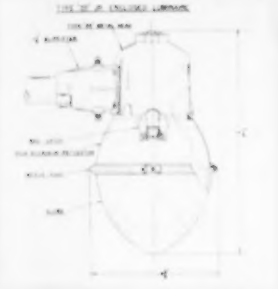
— SUPERHEATER, INC.
200 MADISON AVENUE, NEW YORK 16, N. Y.

C·E

JUNIOR LUMINAIRE
By
JOSLYN

IDEAL FOR RESIDENTIAL AREAS

BEAMS THE LIGHT FOR GREATEST EFFECTIVENESS ON THE STREET



FOR RESIDENTIAL STREET LIGHTING

The Joslyn Junior Luminaire will give you a compact, low cost, glassware enclosed light source embodying the same advantages of scientifically controlled illumination available with larger, more expensive luminaires.

1. For 1000 and 2500 lumen incandescent lamps.
2. Available now in I.E.S. Types IV & V Light Distributions.
3. Slip-Fitter or Top-Mounted Cast Aluminum Head for Inner Wiring.
4. Highly polished Alzak* Spun Aluminum Reflector to which globe is attached by means of the highly successful Joslyn wedge band construction.
5. With W.P. Series, D.P. Series Receptacle, or Mogul Multiple Socket (with standard head) or with Medium Multiple Socket (with smaller head as shown above).

*Mfg. under Aluminum Co. of America Patents.

Branch offices in principal cities

•

THE JOSLYN CO.
THE SOUTH EAST-JOSLYN CO.
SOUTHERN JOSLYN CO.
JOSLYN SOUTHWEST CO.
JOSLYN PACIFIC CO.

JOSLYN

Complete Pole Line Equipment

20 NORTH WACKER DRIVE, CHICAGO 6, ILL.

G. AND
PPLY CO.

YOU NAME IT...

...YOUR CENTRAL CONDUIT DISTRIBUTOR HANDLES IT

Your Central Conduit Distributor handles a wide selection of quality products for every type of electrical job. Among the many lines he handles is Central Rigid Steel Conduit that comes in four different types:

Cenlaco has a hot dipped galvanized and lacquered finish.

Central White has an electro-galvanized outside finish and a black enameled inside finish.

Central Black has a permanent, baked-on black enamel finish inside and out.

Central EMT is a light-weight conduit with an electro-galvanized outside finish and has a durably lacquered inside finish.

All four types are made to Spang's rigid quality standards. It's the kind of quality that reflects in outstanding product performance . . . makes Central Conduit easy to cut, bend and thread . . . standards that help you save time on the job.

When you need conduit or other electrical supplies, call your Central Conduit Distributor. In spite of the great demand, he'll do everything in his power to fill your order as quickly as possible.

SPANG-CHALFANT

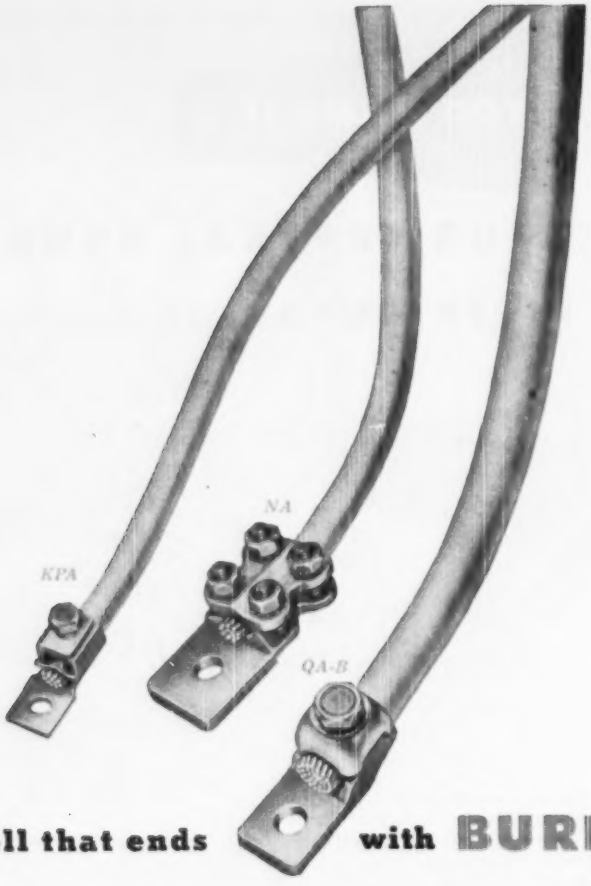
Division of The National Supply Company
General Sales Office: Grant Bldg., Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities

CENLACO a hot dipped galvanized and lacquered finish, inside and out.

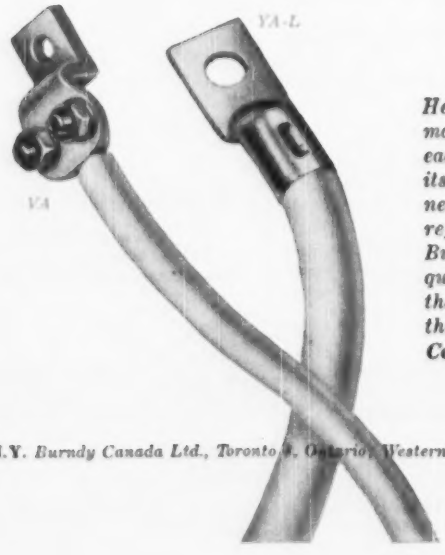
CENTRAL WHITE electro-galvanized outside and black enameled inside.

CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

EMT—Light-weight electro-galvanized outside and durably lacquered inside.



all's well that ends with BURNDY



Here are just a few of many Burndy terminals—each one designed to do its specific job... faster, neater, better!—each reflecting the famous Burndy "engineered" quality—each one proof that, for best results in the end, it pays to ***Connect with*** **BURNDY**

BURNDY, New York 54, N.Y. *Burndy Canada Ltd., Toronto 9, Ontario. Western Branch: Vernon 11, California*

Kentucky Utilities Company, Inc. chooses

Steel Towers

for 138 K. V. Single Circuit Line

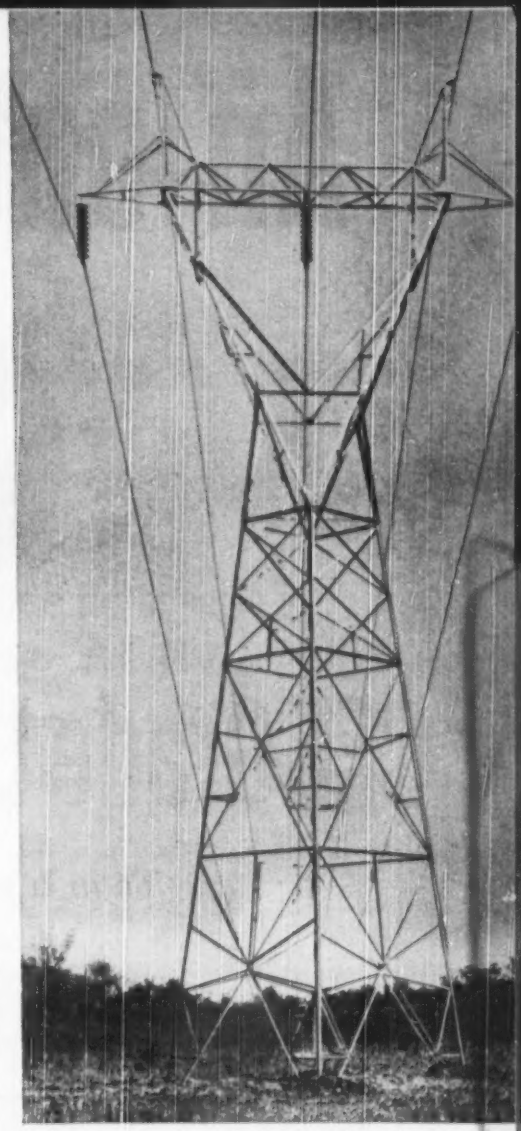
● When Kentucky Utilities Company, Inc., selected American Bridge light steel towers for its 138 K.V. single circuit line, it found that these towers made possible more severe design conditions because they had sufficient strength to carry longitudinal, transverse and vertical loads. Also, Kentucky Utilities found that foundation erection was quicker and cheaper because the circular steel grillages of the towers were designed to permit machine boring of anchors. Conductors and ground wires were carried in the most economical spans and the exact arrangement desired. And, like most things made of steel, these towers have the stamina to provide extra years of service.

To help you take advantage of the outstanding superiority of steel for structures of this type, American Bridge Company makes available its experience and facilities for designing, fabricating and erecting. Why not submit any questions you might have to our nearest Contracting Office.

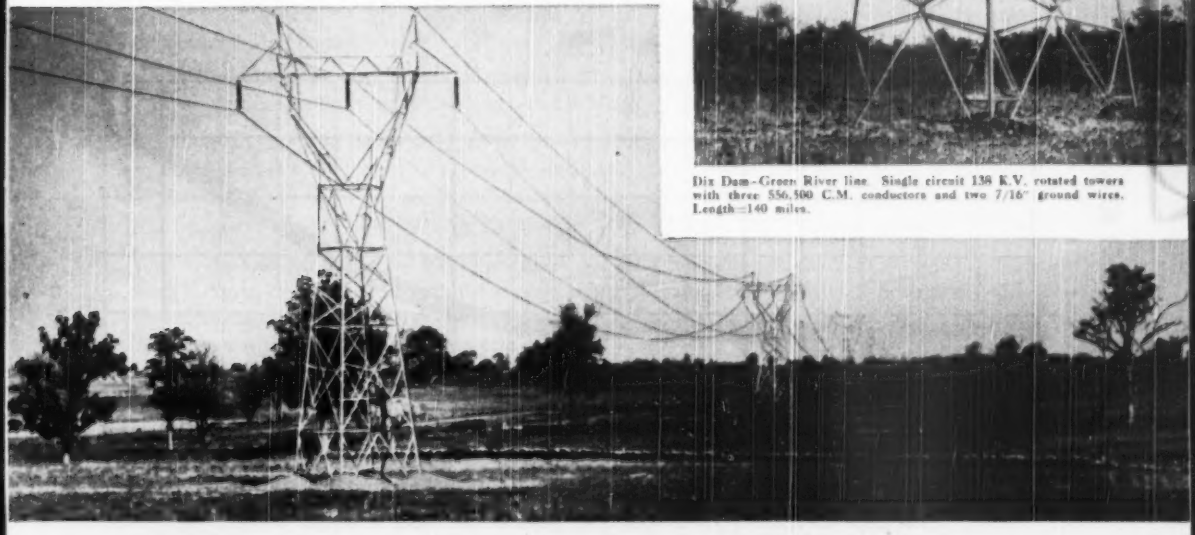
AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

Contracting Offices in: AMBRIDGE · BALTIMORE · BOSTON · CHICAGO · CINCINNATI · CLEVELAND · DENVER
DETROIT · DULUTH · ELMIRA · GARY · MINNEAPOLIS · NEW YORK · PHILADELPHIA
PITTSBURGH · PORTLAND, ORE. · ST. LOUIS · SAN FRANCISCO · TRENTON
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



Dix Dam–Green River line. Single circuit 138 K.V. rotated towers with three 556,500 C.M. conductors and two 7/16" ground wires. Length—140 miles.



USS

AMERICAN BRIDGE

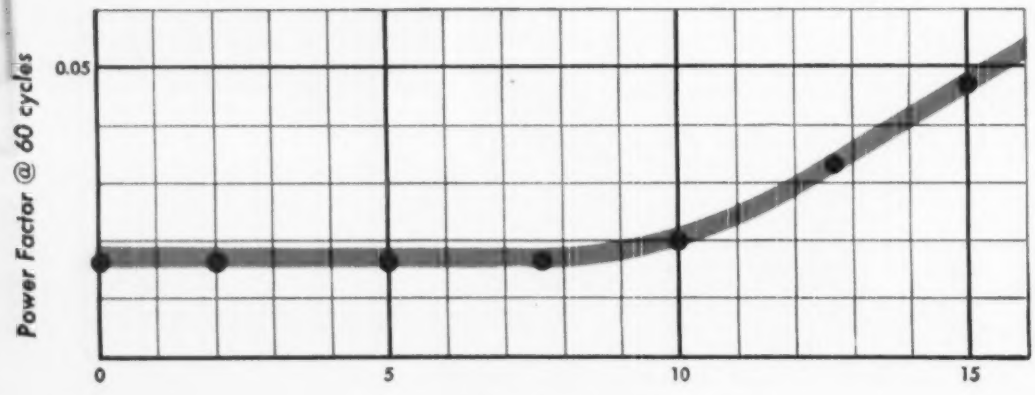
UNITED STATES STEEL

An outstanding

MICA ELECTRICAL INSULATION

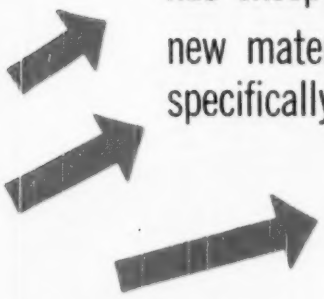
CEE Grade Lamicoid® #6050

It's in a class by itself!



The graph above shows power factor at 60 cycles for CEE Grade LAMICOID #6050 at various crest kilovolt stresses when tested in accordance with ASTM Designation D-150-47T after conditioning for 24 hrs. at 100° C.

DEVELOPMENT !



has exceptionally low power factor at 60 cycles!

new material tailored
specifically for transformer applications means:

lower losses
higher dielectric strength
lower water absorption

Here's a brand new grade of LAMICOID developed by Mica Insulator Company especially to provide good electrical properties for high voltage use at commercial power frequencies.

Class A insulation, designed to withstand a "hottest-spot" temperature of 105 C (221 F), CEE Grade LAMICOID #6050 is ideal for oil-filled transformers, terminal boards and regulator switchplates. Here's why:

Its low power factor at 60 cycles provides an important advantage in transformers being manufactured to present-day specifications.

Because it is an exceptionally low loss material, LAMICOID #6050 does not heat up as readily as high loss materials when subjected to ordinary operating conditions.

Its dielectric strength parallel to the laminations is unusually high for canvas based laminates—60.0 KV plus when tested in oil at 85° C, using #3 taper pins 1" apart.

Its water absorption is unusually low for canvas based laminates—0.35% when tested in accordance with procedure outlined in ASTM designation D-570.

In addition, the new LAMICOID #6050 has good aging characteristics, and won't blister or delaminate in hot oil at 105° C. Made of selected quality fabric base material and special thermosetting resins, it's tough and strong—provides good mechanical support for conducting elements, coils, etc. LAMICOID #6050 can be supplied in sheets 36" x 42".

Products like LAMICOID #6050 are developed by getting down to cases. We've had 57 years' experience doing just that—*and* coming up with the answers, a line of high quality insulating materials. Your problem is our opportunity to make this experience pay off—for *both* of us. That's why we're glad to hear about your problems—and to work with you in developing materials tailored exactly to your requirements. Why not get in touch with our technical service staff today?

MICO ELECTRICAL INSULATION

MICA *Insulator* COMPANY

Schenectady 1, New York
Offices in Principal Cities

GEORGE H. WAHN CO.

Everything Electrical

"Wahnco" Specialties

80-100 HIGH STREET corner of CONGRESS STREET

BOSTON 10, MASSACHUSETTS

October 6, 1950

Remington Rand Company
140 Federal Street
Boston, Massachusetts

Gentlemen:

Since installing the Remington Kardex Graphamatic System eighteen months ago for our Perpetual Inventory, I have found this visible card index has resulted in a great saving of time by the operators, and of money for the firm.

One of the things I like about it is the ease with which a complete list of customers' back orders can be kept by using the Back Order Card. The visible picture of the inventory turnover, without studying each card, has resulted in greatly increased merchandise turnover, and savings in warehouse space. Both of these have eased the financial problems in carrying a proper inventory.

Your system has proved very effective and all connected with its operation are highly pleased. The assistance given us by your representative, Mr. Charles Featherston, and his co-workers was invaluable in starting and operating this system effectively.

Cordially yours,

R. Irving White

R. Irving White
Supervisor

RIW/jm

All these savings, plus 2 Warehouses instead of 3!

Before George H. Wahn Co. installed their Kardex Inventory Control, they needed three warehouses. Today they operate efficiently with only *two*.

Impressive savings like this, together with faster turnover and lowered clerical costs, are common wherever Kardex takes over Inventory Records. For Kardex gives realistic and speedy ***control*** of inventory. The visible signals automatically flash reminders you can't ignore, in ample time to take necessary action. You can find all the facts on this flexible, cost-cutting system in Booklet KD 375. Send the coupon today for your free copy.

Management Controls Reference Library
Room 1519, 315 Fourth Avenue, New York 10

Gentlemen: Yes, I would like to have your Booklet KD 375 "How to Make Profits from Inventories."

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Remington Rand INC.

MOTOROLA GUARANTEES YOU

Uni-Channel Permanent Selectivity

Motorola's new UNI-CHANNEL SENSICON DISPATCHER is proof against adjacent channel interference, and by a simple interchange of the marvelous PERMAKAY wave filter, it will carry you through "split-channel" traffic when it comes. Motorola Sensicon equipment with 8 exclusive developments sets the pace in the 2-way radio field! It's your buy today and your protection against obsolescence for years to come.

FM 2-WAY RADIO

Motorola

4545 AUGUSTA BLVD., CHICAGO • ROGERS MAJESTIC ELECTRONICS, LTD., TORONTO, CANADA

COMMUNICATIONS & ELECTRONICS DIVISION

OVER 20 YEARS — SPECIALISTS IN MOBILE RADIO

"Our teamwork improved...

when we picked FWD matched combinations of truck and equipment to fit the job"

"Sure, trouble comes with bad weather ... but bad weather doesn't slow up our FWDs"

"Our FWDs last longer because there's less strain ... both load and power are properly distributed"

"Now we restore service faster..thanks to FWD"

Today's trend to FWD is due to this growing realization:

A utility's all-season performance on maintenance and construction is materially influenced by the *type of vehicle* employed!

It is common knowledge that no other truck can equal FWD when challenged by mud, sand, snow, ice, grades and off-the-road work. But, utilities discover additional dollar-advantages in also using FWD for normal, routine service. These *overall* FWD superiorities are significant assets throughout the economics and public relations of a utility.

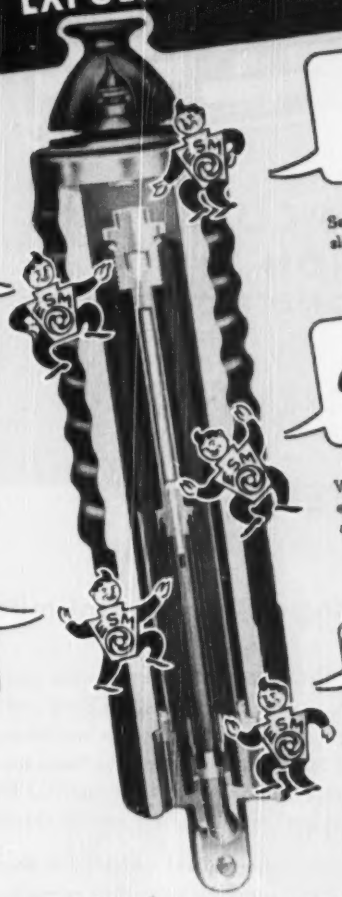
GET FULL FACTS on 38 standardized FWD motorized units. Each combines truck and equipment into one complete, easy-to-buy package — matched to your particular needs. One central responsibility for all equipment. See Graybar or write FWD direct.

THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin • Canadian Factory: Kitchener, Ont.
World-Wide Sales and Service

Distributed by GRAYBAR

America's Foremost Heavy-Duty Truck

PROVED AND APPROVED PROTECTION
KEYSTONE EXPULSION ARRESTER



NO LINE LOCKOUTS

Series gap enclosed; unaffected by sleet, snow or weather.

NO LEAKAGE CURRENT

. . . can flow through fibre arc-quenching element; this eliminates possibility of burning or charring fibre parts.

HIGH SURGE CURRENT CARRYING CAPACITY

Withstands surge current far in excess of NEMA—standard 65,000 amp discharge test.

PARALLEL DISCHARGE PATHS ASSURE LONG LIFE

Less follow current per path; reduces fibre erosion to minimum; which assures longer useful life.

LOW ARC RESISTANCE

. . . prevents complete chopping of voltage wave impressed across transformer insulation. Prolongs insulation life.

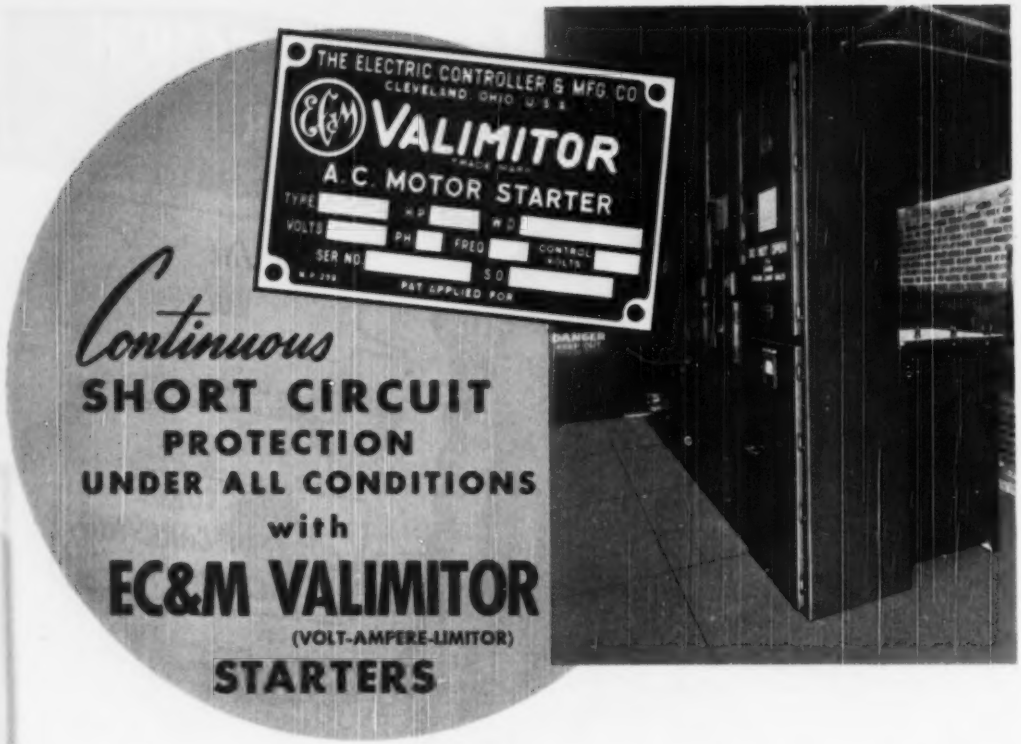
New features of construction . . . new technical advances proved in service . . . backed by 57 years of specialized experience in the field of lightning protection—all this adds up to the best there is in expulsion arresters!

The new Keystone expulsion type arrester provides low impulse sparkover and excellent transformer protection . . . high surge current carrying capacity . . . and its many new features assure long life of arresters and transformers.

This is just one of the many new developments by ESM. More are on their way! New technical and instructional data will soon be available on the basic fundamentals of purchasing and applying lightning arresters. Get your copy of our latest lightning arrester booklet . . . result of more than a year's work by our engineers . . . complete technical data. Just off the press. Yours for the asking . . . no obligation.

ELECTRIC SERVICE MANUFACTURING CO.

1709 CAMBRIA STREET PHILADELPHIA 32, PENNA.



Continuous
SHORT CIRCUIT PROTECTION UNDER ALL CONDITIONS with EC&M VALIMITOR (VOLT-AMPERE-LIMITOR) STARTERS

Unrestricted by starting currents - Unlimited by available KVA

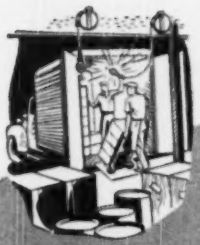
EC&M VALIMITOR Motor Starters provide *safe* protection under fault currents of *any* size. Protection *does not lapse*—no fuses to blow. The circuit is opened by the well-known EC&M Type ZHS heavy-duty, Magnetic Contactor. The Valimitor coils in these starters limit the maximum fault current to 25,000 KVA or less. The bus which supplies the fault current may be of infinite KVA.

Equally important—EC&M VALIMITOR Starters for 2300-4600 volt motors are unrestricted by starting currents. No need to worry about inrush currents nor calculate KVA capability. These EC&M Starters have high thermal capacity to withstand frequent starts and they may be used with high inrush motors.

EC&M VALIMITOR Starters simplify purchasing routine. Merely state HP, voltage, phase and frequency. Use EC&M VALIMITOR Starters for 2300-4600 volt motors—and *be sure of continuous protection.*

FOR COMPLETE FACTS— *Ask for T9-117 Reprint Bulletin*

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79th STREET • CLEVELAND 4, OHIO



It's Here! . . . a Great NEW APPLETON REELITE

Shown above is the New Appleton 7S Series Portable Reelite. At right, the new reel equipped with RE-H3SR handlamp.

■ Announcing the new, *all new*, Appleton 7S Portable Reelite—a compact, automatic cord take-up reel that solves the countless lighting problems of car-loading, machine inspection, maintenance work—any job that requires good illumination in out-of-the-way places.

Double silver alloy collector brushes—one of many outstanding new features—permit continuous rotation of the entire reel in either direction without power interruption or tangling of the cord. This versatile device furnishes light—or a flexible power source for power tools—when and where you want it. Positive stop action holds cord at desired length, up to 25 feet; then cord is automatically re-reeled when job is done.

The Appleton 7S Portable Reelite is completely encased in steel, finished in baked hammertone enamel. It is easily installed on any 4" octagonal outlet box. Available accessories include six types of handlamps, machine tool connector body or key socket. A vaporproof model is furnished with handlamp. Write for details on this and other Portable Reelites.

Sold Through Electrical Wholesalers

APPLETON ELECTRIC COMPANY

1703 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

Branch Offices: NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna St. ST. LOUIS, 227 Frisco Bldg. • LOS ANGELES, 100 N. Santa Fe Avenue • ATLANTA, 724 Boulevard, N.E. • BIRMINGHAM, 429 Brown-Marx Bldg. MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 414 Bessemer Bldg. • BALTIMORE, 100 East Pleasant St. • BOSTON, 10 High Street • DENVER, 1921 Blake Street PHILADELPHIA, 1017 Cherry Street • CINCINNATI, 626 Broadway • HOUSTON, 709 M. & M. Bldg. • HAVANA, Cuba, Malecon No. 9.

Resident Representatives: Binghamton, Dallas, Indianapolis, Kansas City, Orlando, Milwaukee, New Orleans, Seattle, Portland, Ore.

Export Representatives: International Standard Electric Corp., 67 Broad St., New York 4, N. Y.

APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

STRIKE?

no..they're out because of a broken bolt!

You're looking at a group of production workers who have been laid off temporarily—because a certain bolt in an all-important drive corroded to failure.

One of the most regrettable aspects of this situation is that it *could* have been avoided . . . by specifying non-ferrous or stainless steel fastenings at the time the equipment was purchased; or by replacing common steel fastenings *on delivery* with bolts, nuts, screws, rivets and accessories that *resist* corrosion.

Harper specializes in these Everlasting Fastenings; makes them in over 7000 different sizes, types and alloys—Brass, Bronzes, Copper, Monel and Stainless Steels. Large quantities are maintained in stock for immediate delivery to manufacturers everywhere who know by experience the extra qualities you get in Harper fastenings—better appearance, longer life, ease of cleaning and resistance to high temperatures. They're most economical in the long run.

Write today for 134-page catalog and current stock list. The H. M. Harper Company, 8205 Lehigh Avenue, Morton Grove, Illinois

New York Office and Warehouse: 200 Hudson St.
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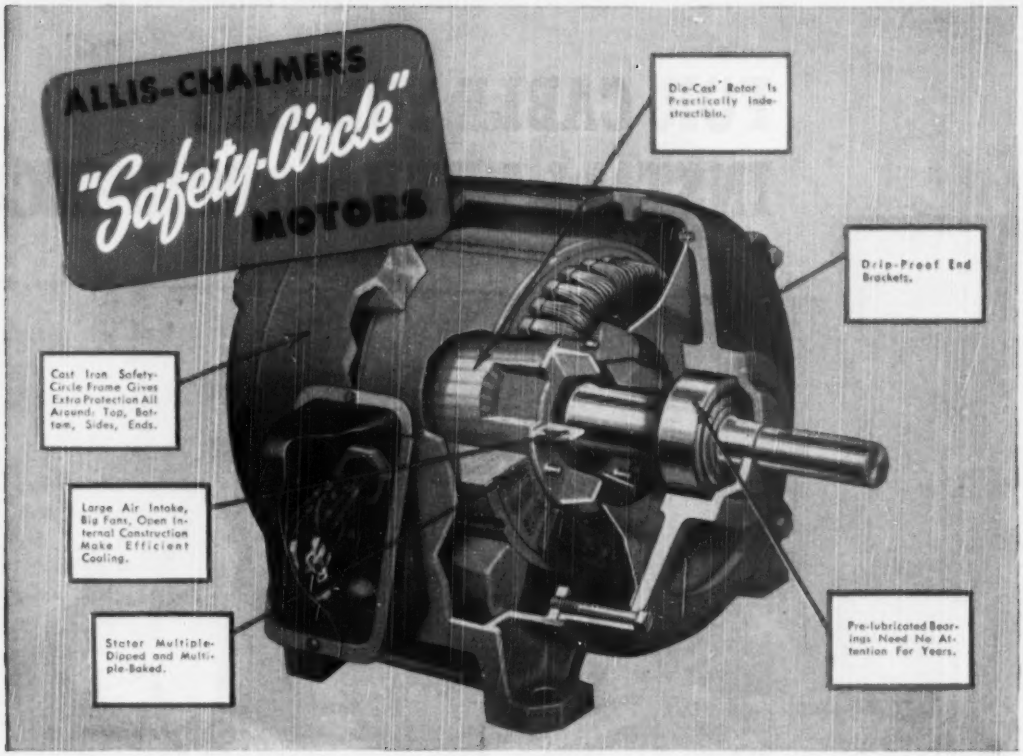
Branch Offices: Atlanta, Cambridge, Cincinnati, Cleveland, Dallas, Denver, Detroit, Grand Rapids, Milwaukee, Oakland, Philadelphia, Pittsburgh, St. Louis, Seattle, Toronto (Canada)

AMERICA'S LEADING SPECIALIST IN NON-FERROUS AND STAINLESS STEEL FASTENINGS

HARPER

EVERLASTING FASTENINGS


ALLIS-CHALMERS
"Safety-Circle"
MOTORS
Die-Cast Rotor Is Practically Indestructible.
Drip-Proof End Brackets.
Cast Iron Safety-Circle Frame Gives Extra Protection All Around: Top, Bottom, Sides, Ends.
Large Air Intake, Big Fans, Open Internal Construction Make Efficient Cooling.
Stator Multiple-Dipped and Multiple-Baked.
Pre-lubricated Bearings Need No Attention For Years.

HOW SAFETY-CIRCLE

Means Motor Dependability

EXTRA PROTECTION means extra dependability. That's why Allis-Chalmers protects the working parts of the motor with the exclusive *SAFETY-CIRCLE*. Compare this motor with motors of less rigid construction. The *SAFETY-CIRCLE* motor will not distort in mounting or under strain. And you get the extra protection of drip-proof end brackets at no premium.

EXTRA PROTECTION INSIDE, TOO

Stator is multiple-dipped and multiple-baked in special insulating varnish. Rotor is die-cast aluminum. Stator is mounted in four longitudinal ribs which leaves plenty of air space between stator and frame. Large fans cast integrally with the rotor and ample air intakes keep temperatures well within rated limits. *Ball bearings are factory-lubricated and require no further attention for years.*

When you shop for motors, remember *SAFETY-CIRCLE* gives you *extra protection, extra dependability* and *lower operating costs.*

For details on *SAFETY-CIRCLE* advantages, see your A-C Authorized Dealer or Sales Office or write for Bulletin 51B6210B. Sizes 1 to 20 hp, 326 frames and smaller. *Safety-Circle, Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks. A-3146

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Sold . . .
Applied . . .
Serviced . . .

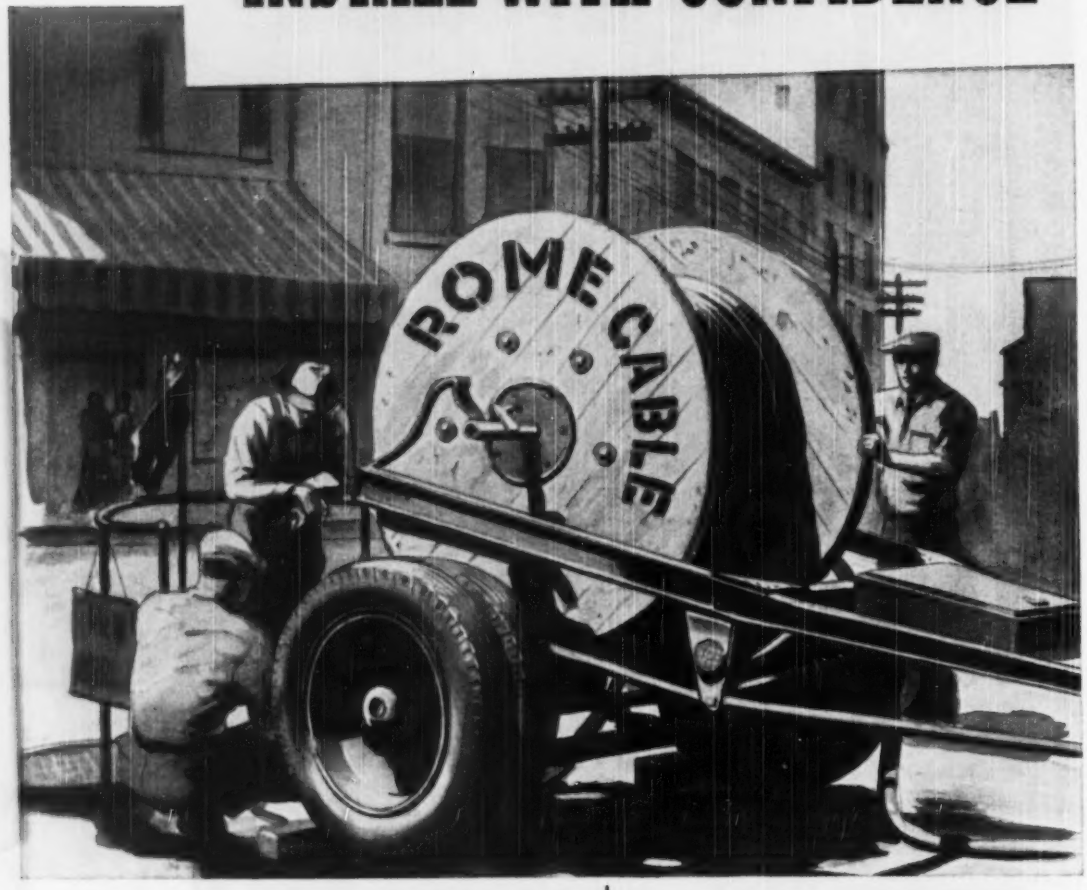
by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

FOR CABLE YOU CAN INSTALL WITH CONFIDENCE



Multi Conductor RoZone-RoPrene® Power Cable—5000 Volts

RoZone-RoPrene Station Control Cable—600 Volts

Single Conductor RoZone-RoPrene Power Cable—8000 Volts Ungrounded Neutral

RoZone-RoPrene Series Street Lighting Cable—2001 to 8000 Volts

SPECIFY RoZone*

The Superior Ozone Resistant Insulation

In high voltage applications where long service life under severe conditions is imperative, Rome RoZone insulation is outstanding. A high quality oil-base compound, its resistance to corona and ozone cutting is exceptional. This, combined with unexcelled resistance to moisture, as well as aging, heat and sunlight, makes Rome RoZone insulated cable completely trouble-free . . . a cable you can install with complete confidence.

Rome RoZone is the result of years of successful operating experience, modern chemical knowledge, materials and up-to-date facilities. Its remarkable stability in water recommends it as the insulation for cables to be buried direct in earth, in wet locations, even for d-c operation where electro-osmosis presents a difficult problem. High dielectric and impulse strength, excellent aging characteristics, plus immunity to corona and ozone cutting especially quality Rome RoZone as a superior high voltage insulation.

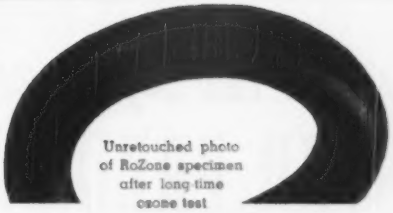
The dependability and high quality of Rome RoZone have made it *first choice* for many applications.

Rome RoZone is the Ideal Insulation for:

High Voltage Power Cables
Series Street Lighting Cables
Station Control and Signal Cables
General Purpose Wiring Where Dependable Quality is Paramount

It Costs Less To Buy the Best

*T. M. Reg.



Check These Rome RoZone Premium Quality Features:

- High Dielectric and Impulse Strength
- Excellent Resistance to Corona and Ozone Cutting
- Remarkable Electrical Stability in Water
- Inherent Resistance to Heat, Aging and Sunlight

JUST OFF THE PRESS!

The New Rome Power and Control Cable Catalog

This new sixty-page catalog will be an important addition to your book shelf! Complete in every detail, it includes descriptions, specifications, test data and suggested applications for all Rome Power and Control Cables. You'll find it invaluable for specifying. Mail coupon below today!

ROME CABLE Corporation
ROME · NEW YORK
From Bar to Finished Wire

ROME CABLE CORPORATION, Dept. EW-11, Rome, N. Y.

Please send copy of new Rome Power and Control Cable Catalog.

Name .....

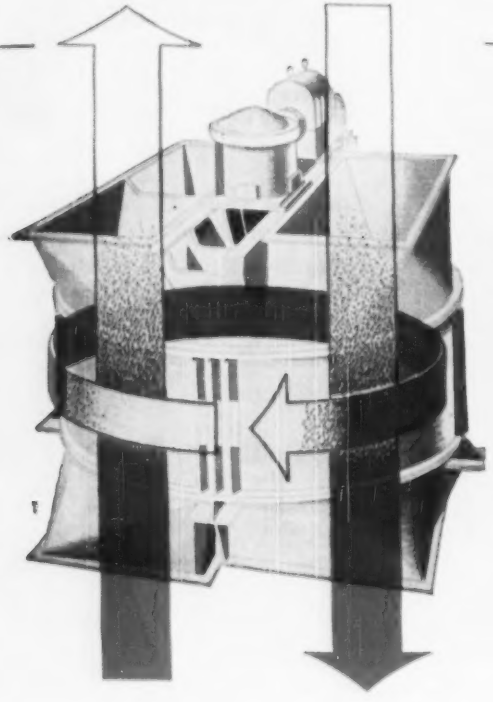
Company .....

Address .....

City ..... Zone ..... State .....

Increase the efficiency of your present boiler

with the *Ljungstrom* AIR PREHEATER



The installation of a Ljungstrom air preheater on your present boiler offers the opportunity for considerable fuel savings that will more than offset the initial cost of the preheater in a matter of a few years.

The regenerative counterflow principle of the Ljungstrom permits operation at lower exit gas temperatures . . . assuring increased heat recovery and reducing the amount of fuel required. Moreover, the compactness and lightness of the preheater makes it possible to install it on your present boiler with minimum change in the existing structure.

For more information as to how you can approach modern performance standards with a boiler that is operating without an air preheater, or with out-of-date air preheater, write to the Air Preheater Corporation. Our engineers will welcome the opportunity to show you how the Ljungstrom can raise the over-all efficiency of your plant.

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

THE AIR PREHEATER CORPORATION

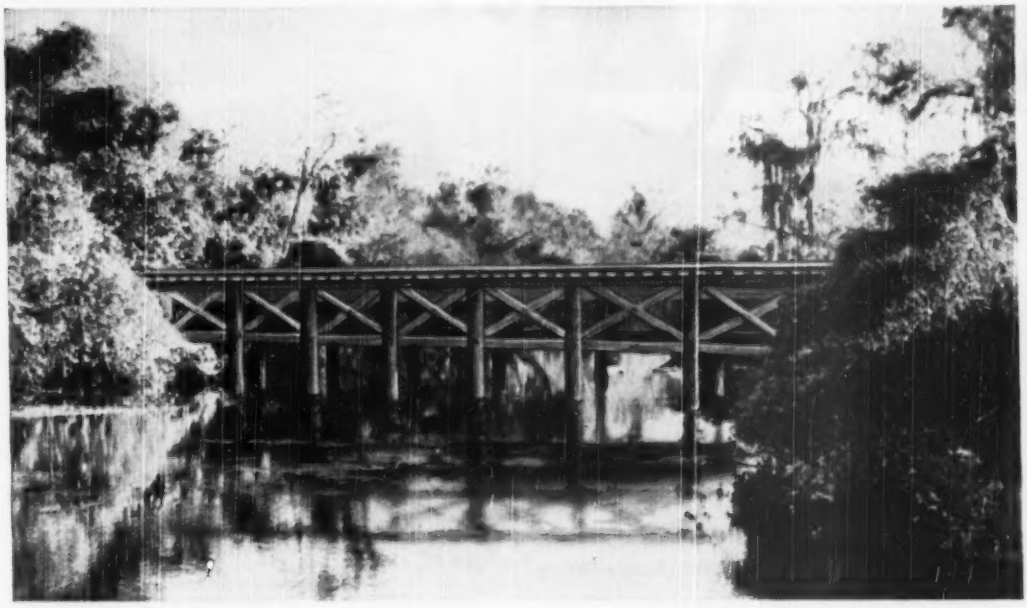
60 EAST 42nd ST. · NEW YORK 17, NEW YORK

WHEREVER YOU USE WOOD..

IN THE SWAMPS, forces of decay are almost at their maximum of destructive power. High moisture content and infection from other decaying wood and debris are ever-present menaces. Poles properly treated with BARRETT* Coal-Tar Creosote have survived under swamp conditions for years.

IN THE SOUTH, prolonged high temperatures cause light-bodied preservatives to leach and evaporate from the wood, thus exposing the wood to termite attack and decay. BARRETT Coal-Tar Creosote, heavier bodied and of lower volatility, prevents this condition. It stays in the wood longer under all conditions—doesn't "run out" on the job.

IN THE DESERT, crossties broom, shatter and split from extreme dryness and heat. Solutions made with BARRETT Coal-Tar Creosote retard this, and also reduce mechanical wear of crossties through their lubricating action on the wood fibers. In poles, heavy treatment with BARRETT Coal-Tar Creosote substantially reduces checking and splitting.



IN THE NORTH, poles must resist the tremendous weight of frequent sleet storms. Avoid preservatives which *weaken* the wood. BARRETT Coal-Tar Creosote allows poles to retain their maximum strength, and helps to keep the poles at their best and hold the lines aloft.

IN FRESH WATER, many preservatives leach out of wood. BARRETT Coal-Tar Creosote resists this leaching action. Being only negligibly soluble in water, it is the preferred preservative for use on submerged wood structures, or those exposed to the powerful action of rapidly flowing water.

IN SALT WATER, marine wood-borers give a preservative its severest test. Of hundreds of preservatives that have been tried through the years, *Coal-Tar* Creosote is the only one that has proved consistently effective against teredos, limnoria and other salt-water enemies of wood.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Use Barrett* →

*Reg. U. S. Pat. Off.

Only coal-tar creosote wood preservative has been used long enough and widely enough to have proved its effectiveness under all conditions.

COAL TAR CREOSOTE

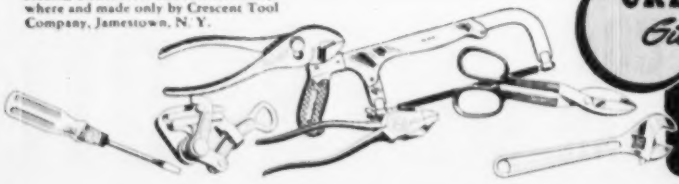
HACKSAW THAT'S EASY TO USE WITH A HANDLE THAT'S HARD TO BREAK!

● To the experienced mechanic the "feel" of a tool is important. The Crescent #1049 Hacksaw has a molded-to-the-hand Neoprene handle that is a great improvement over metal. For one thing, it takes a lot more abuse. It is comfortable and resilient to hold and has high dielectric value. The frame has all the expected Crescent Quality features...made of heavy gauge steel...nickel-plated for corrosion resistance ...beautifully balanced. You'll find all the features that make a good hacksaw in this Crescent model.

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

EASY ON THE HAND AND HARD TO BREAK
Feel it . . . it's warm and resilient to the touch. Drop it . . . it won't break. Use it . . . it is impervious to oil and acids. Temperatures 100 degrees below to 200 above will not affect it. Has high insulating value under all conditions.

"Crescent" is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by Crescent Tool Company, Jamestown, N. Y.

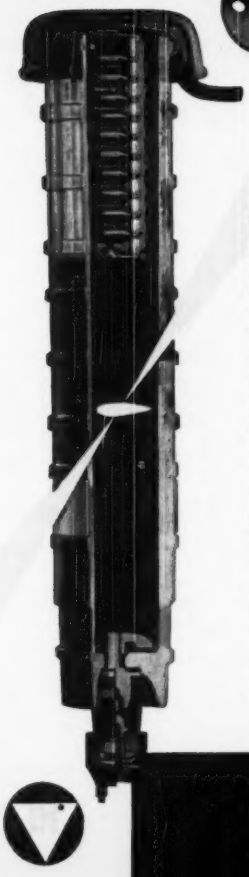


CRESCENT TOOLS
Give Wings to Work
Sign of the Artisan
Symbol of Excellence

PROTECTION TODAY

LENS

for a lightning arrester



Here is how L-M Valve Type Arresters counteract "skin effect," and why L-M's "Granulon" characteristic element has such high discharge capacity and unchanging characteristics.

Lightning follows the path of least resistance—electrically. Also, like 60-cycle current in a conductor, it tends to "skin" down the outside of the valve element. In a lightning arrester, when the resistances down the middle and side of the valve element are the same, the surge invariably tends to channel down the outer edges.

The result? Repeated surges lower the discharge capacity, and in time the arrester clinkers, and fails. Usually nobody knows why, and attributes the failure to a direct stroke.

In L-M's "Granulon" characteristic element, *lens-shaped metallic electrodes* shorten the electrical distance down the center just enough to counteract the skin effect. The surge discharges evenly all through the "Granulon"—and the arrester lasts far longer.

The arrester can take *more* heavy surges . . . it maintains its high discharge capacity without change for years and years . . . rate of failure is gratifyingly low.

(Incidentally, that is why L-M is the only manufacturer who *dares* to put his arrester into a Pyrex® glass housing. You can *see* any signs of failure—which is so rare in L-M arresters we don't mind taking the cat out of the bag!)

Other features: precision gap, maintains low sparkover and fast action on both long low and steep front waves . . . draws negligible follow current—permits accurate fuse coordination . . . The Isolator, L-M's patent insurance feature—the arrester can never ground feeders. In all distribution voltages . . . Meets NEMA Standards and more!

GET THIS BOOKLET—JUDGE FOR YOURSELF

Ask the L-M Field Engineer for a copy of Bulletin LA1, or write Line Material Company, Milwaukee 1, Wisconsin (A McGraw Electric Company Division)

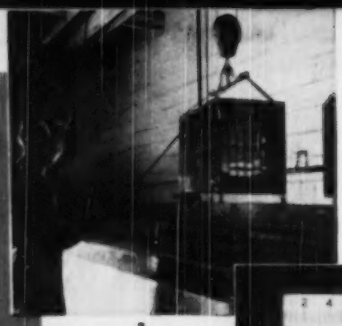
7488

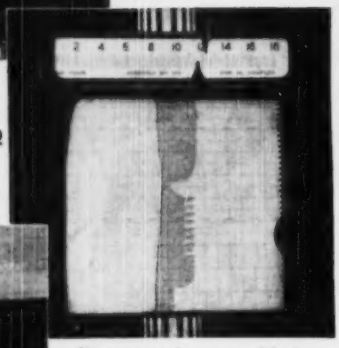
LINE MATERIAL Lightning Arresters

Complete Coordinated Equipment for Distribution Today

how L-M STOPS RUST

of line construction materials



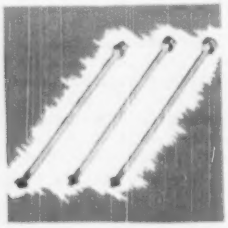


Illustrations show some of the important factors in L-M hot dip galvanizing. (1) improved methods of degreasing, pickling, and washing to assure clean surface and perfect adhesion . . . (2) precise temperature controls to assure even coatings . . . (3) centrifuging removes excess zinc to assure clean threads.

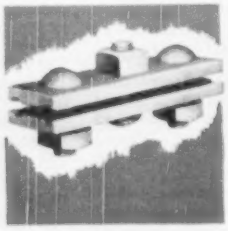
● Good galvanizing, under controlled conditions, is the secret of the quality of L-M construction materials.

Pinholes in galvanizing invite rust. Uneven coatings wear through in spots. A coating that's too thick, or rough, makes nuts turn hard, slows down the lineman. So L-M takes all possible precautions to assure smooth, even coatings, that stop rust as long as possible.

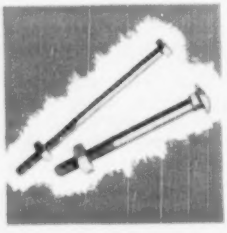
For information about L-M equipment, ask the L-M Field Engineer, or call the nearest of 77 L-M sales offices and warehouses throughout the country, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



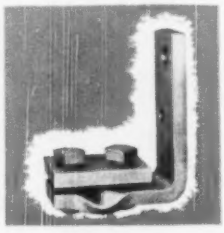
Strand Eye Anchor Rods, in single, double, and triple eye styles, do away with the elusive thimbles. Rod eyes conform to curvature of guy strand, permit the strand to be pulled tight without distortion.



L-M Guy Clamp, with high-strength bolts and Torkol-treated nuts for easy tightening, firm holding, with no thread-corrosion. Heavy steel, hot-dip galvanized. Square holes keep bolt from turning.



Machine and Carriage Bolts have clean-cut threads, true heads, ample tensile strength. L-M bolts 6" and longer have buffer points for easy driving —in, and for driving out without battering threads.



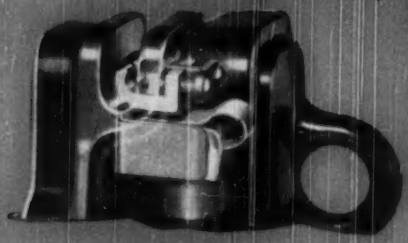
Universal Messenger Hanger for minimum clearance between pole and conductor. Flared groove prevents nicking the strand and permits use of this hanger on both small angle and straight runs.

24-E

LM

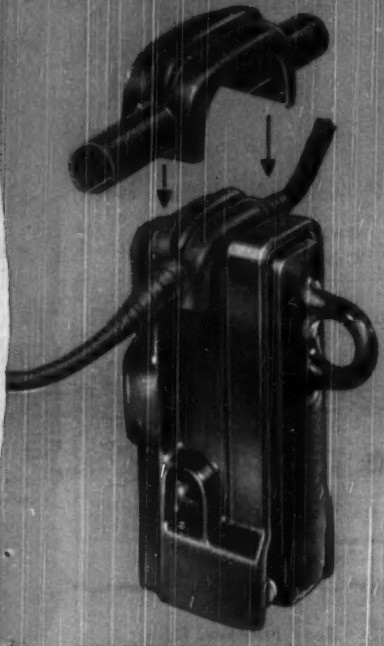
LINE MATERIAL . . .

Line Construction Materials

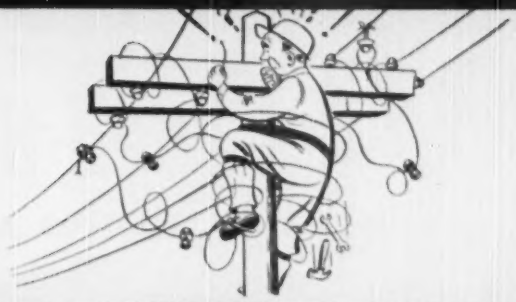


Phantom view of line conductor clamp. Jaws designed to prevent deformation of conductor. Tightened by two screws from front of cutout.

Insulation is skinned from about four inches of the conductor, which is then dropped into the slot in top of the cutout.



L-M PVD-562 Drop-out Indicating Cut-out, 50 amps, 5000 V. Flexible synthetic hood grips top of housing and protects cut ends of insulation, completely weatherproofing the job.



why get complicated?

It's so simple to hook up aerial cable to

L-M's PVD-562

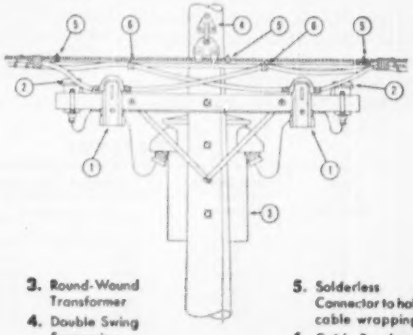
aerial cable FUSE CUTOUT

You don't need a truckload of equipment and a lot of complicated connections when you use the new L-M Aerial Cable Fuse Cutout. It's the first drop-out cutout designed especially for aerial cable. It's a tremendous help when you install aerial cable.

You don't cut the cable. Just skin it, and drop it into the slot. Copper-jawed clamp centers the cable, and grips it firmly without distorting the conductor. Flexible synthetic hood waterproofs the top of the cutout box and protects cut ends of the insulation. Ears of the hood are wrapped around the cable and taped. A neat, efficient installation that's fast and easy to make.

The L-M PVD-562 has the same indicating and operating features as the famous PVD-56. But it's designed especially for aerial cable. For details, ask the L-M Field Engineer for Bulletin AC1, or write Line Material Company, Milwaukee 1, Wisconsin (A McGraw Electric Company Division).

Installation of L-M Aerial Cable Cutout with Single Phase Transformer. No tee taps needed. You don't even cut the conductor!



1. PVD-562 Fuse Cutouts
2. Valve Type Lightning Arrester
3. Round-Wound Transformer
4. Double Swing Suspension Bracket
5. Solderless Connector to hold cable wrapping
6. Cable Band

LINE MATERIAL...Aerial Cable Materials

Complete Coordinated Equipment for Distribution Today

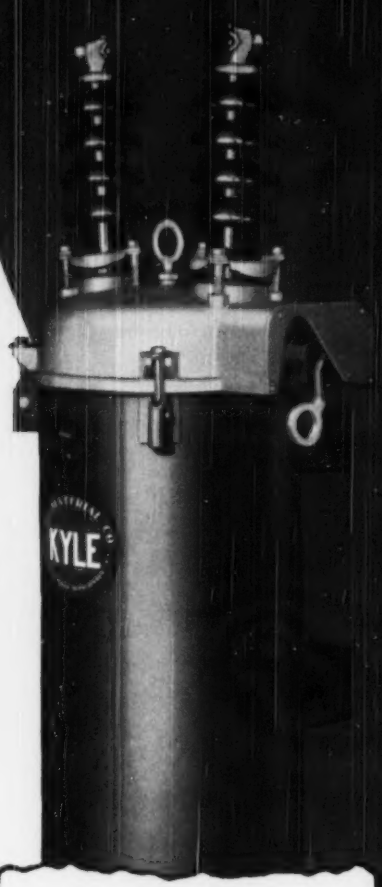
748

KYLE

TYPE "L" OIL CIRCUIT RECLOSER NOW GIVES YOU UP TO

6000 amps interrupting capacity

IN NEW 140-AMP RATING



First recloser actually engineered for heavy-duty service . . . full power-class design . . . 110 kv insulation impulse level . . . ratings up to 140 amps . . . only real heavy-duty recloser in its class

Kyle type "L" reclosers cost a little more than lighter-duty reclosers, but they're worth the difference in service, performance, convenience, and freedom from maintenance. Even if you don't need the extra interrupting capacity now, you will need it to take care of future loads; and in the meantime you enjoy all the benefits of type "L" performance and economy.

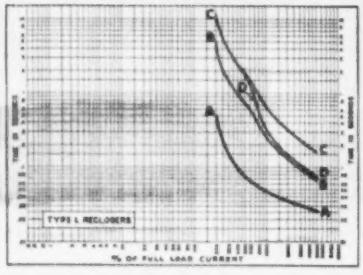
It's the Kyle oil cross-blast method of arc extinguishing, plus heavy-duty design, that makes it possible for the "L" to handle heavy fault currents up to 6000 amps.

The type "L" is the only recloser with so wide a choice of operating sequences. Four standard curves permit any sequence of operation to meet your coordination problems.

Sequence and coil changes are made right in the field—in a few minutes. To change to a coil of different rating, you just remove two screws. To change operating sequence, simply rotate a disc or change one small part. It's quick—and easy! Saves shop trips!

Extremely accurate; virtually no effect from ambient temperature changes. Positive fast operation; positive toggle closing—doesn't depend on gravity. Many safety features: cover and tank electrically dead—bushing tops only live parts; trip-free operating handle. Large sleet hood protects counter and operating handle; may be rotated in 90° steps. Rugged; shock-proof; trouble-free.

ONLY RECLOSER WITH 4 OPERATING CURVES



RATINGS

Coil Rating Amperes	Min. Trip Current Amperes	Maximum Interrupting Capacity Amperes At Maximum Phase-to-Phase Nominal Voltage of		
		4.8 kv	7.2 kv	14.4 kv
25	50	1500	1500	1500
35	70	2100	2100	2100
50	100	3000	3000	3000
70	140	4200	4000	3000
100	200	5000	4000	3000
140	280	6000	4000	3000

Read all about it!

Ask the L-M Field Engineer for a copy of Bulletin CR1A—on the type "L"; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

18

LM

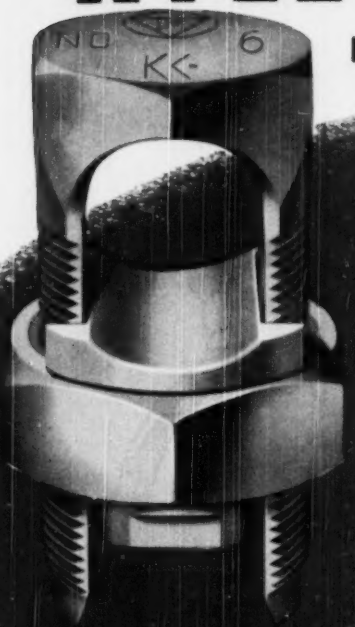
LINE MATERIAL... Kyle Reclosers

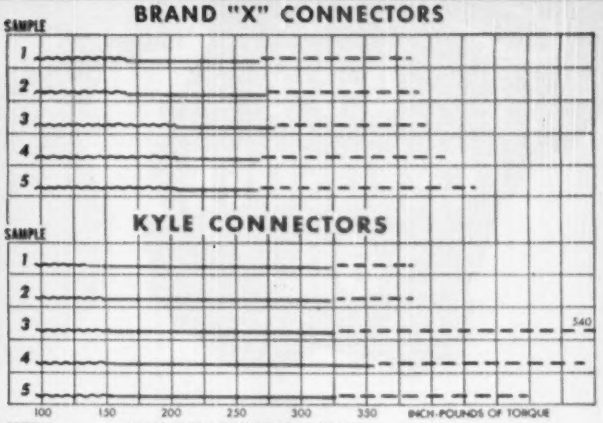
Complete Coordinated Equipment for Distribution Today

TORQUE TESTS SHOW

KYLE Split-Bolt Connectors

HAVE A LONGER WORKING RANGE





● Connector tightening torque test results. Note the long working range of the Kyle connectors, while the Brand X—a typical standard type—broke down much sooner. The chart shows only the tests of the number 6 size; Kyle connectors came out equally well in comparative tests of other sizes.

For our own information, we put the squeeze on a bunch of connectors—with a torque wrench. The test chart shows the results.

Note the *long* working range of the KYLE connectors, and the much *shorter* range of Brand X—a typical, standard-quality connector that looks about like ours. That's valuable information for *any* connector purchaser.

HERE'S WHAT HAPPENS . . . *Some* connectors—but not KYLES—have rough threads. That means extra torque to turn the nut, extra strain on the connector body. Often the pad fits badly and goes a little skew-gee, requiring still more torque. Something has to give—the connector body takes the beating.

But heavy-bodied KYLE connectors have clean, accurately machined threads, smoothly rounded edges, a close-fitting pad. The nut tightens easily, the pad slides up smoothly, the force is on the wire—and the connector comes up without damage while still holding the wire much tighter.

COSTS LESS TO USE . . . A connector that can be used only once is an expensive connector. A connector that can be re-used is more economical. KYLE connectors work better, last longer, and, as the chart above shows, they'll stand lots more torque and still come up ready for re-use. That makes it obvious that you get better connections, and lower costs, when you get KYLES, the long-range, long-life connectors.

● If you want to save money with quality connectors, ask the L-M Field Engineer for samples and a copy of Bulletin SC1 which gives details. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

TIGHTENING TORQUES FOR SPLIT-BOLT CONNECTORS RECOMMENDED FOR BEST RESULTS

Connector size	Inch-pounds
8	75
6	225
4	275
2	350
2 stranded	400
1/0	500
2/0	600
4/0	750

2-R

LM

LINE MATERIAL Kyle Connectors

Looking for long life for poles and crossarms?

Specify U·S·S CREOSOTE OIL

● U·S·S Creosote Oil never varies in quality. It's the product of continuous processing in United States Steel's own tar distillation plant—the largest in the world. Residue content is closely controlled . . . toxicity and penetrating power are consistently high.

In terms of performance, this uniformity means you can expect the same long life from every batch of poles and cross arms treated with U·S·S Creosote Oil. It means you can keep replacement costs unvaryingly low by making it standard practice to specify this time-tested preservative.

You'll have no delivery headaches when you specify U·S·S Creosote Oil, for United States Steel has built an enviable reputation on dependable service. To assure prompt attention to orders, five sales offices have been located strategically from coast to coast.

If you'd like more information on U·S·S Creosote Oil, get in touch with the office nearest you; there's no obligation.

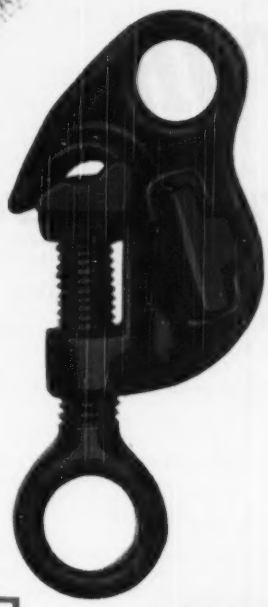
COAL CHEMICAL SALES DIVISION
UNITED STATES STEEL CORPORATION SUBSIDIARIES
71 Broadway, New York 6, N. Y.
208 South La Salle St., Chicago 90, Ill. 1509 Terminal Tower, Cleveland 15, Ohio
Brown-Marx Building, Birmingham 2, Ala. 25 Beale St., San Francisco 5, Calif.

USS

CREOSOTE OIL

UNITED STATES STEEL

MAKE A *Good Connection* WITH WEAVER



1-WS
Copper to Copper
(Also available for general purpose use — 1-WS-C)

WSB-C
Cadmium Plated
General Purpose
(Also available for copper to copper connections—WSS)

K-1 Jumper Clamp
(Also available for aluminum, steel, or copper to similar conductor.)

A-111 Armor Rod Jumper Clamp
(Also available for aluminum to aluminum connections.)

WEAVER HOT LINE CLAMPS are cast of high strength **HERCULOY** to withstand maximum tightening without distortion. This exceptionally hard metal also produces a smooth, free running thread which efficiently converts the tightening torque to pressure on the conductor. **HERCULOY** also eliminates freezing of the tightening bolt so that clamps are easily removable.

Both main line and tap wire connections are secured with **SHAKEPROOF** lockwashers to provide permanent high pressure, trouble-free connections which won't loosen under vibration.

WEAVER HOT LINE CLAMPS are made in only two sizes which accommodate a large range of connections. There is no need to stock a big variety of sizes when you use **WEAVER**.

FOR TOP QUALITY AT LOWEST COST . . . YOU CAN'T BEAT WEAVER HOT LINE CLAMPS!

Write for the latest Weaver Catalogue

JAW

J.A. WEAVER CO.

2110 HOWARD ST. ST. LOUIS 6, MO.

CORNELL-DUBILIER CAPACITOR

field performance records!

4.9 BILLION KVAR/HRS. of trouble-free service
for PACIFIC GAS & ELECTRIC

1.3 BILLION KVAR/HRS. of 99.5% trouble-free service
for BONNEVILLE

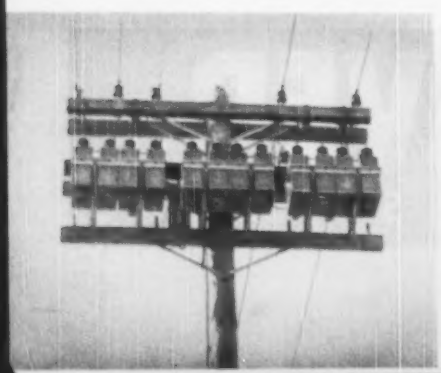
1.5 BILLION KVAR/HRS. of 99.1% trouble-free service
for DETROIT UTILITY

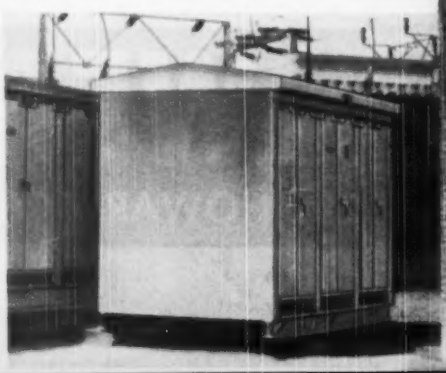
1.5 BILLION KVAR/HRS. of trouble-free service
for LARGE MIDWESTERN UTILITY

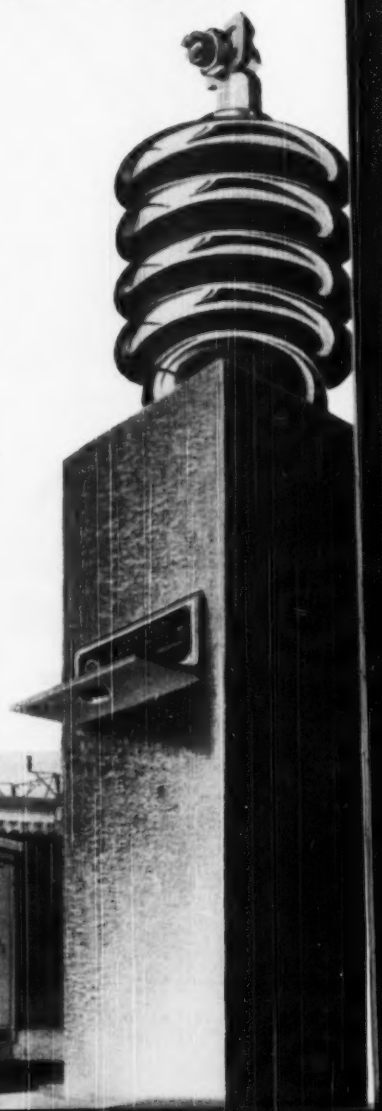
491 MILLION KVAR/HRS. of trouble-free service
for T.V.A.

7 BILLION KVAR/HRS. of Capacitor service
for PUBLIC SERVICE ELECTRIC & GAS OF NEW JERSEY

These field reports from six great power producers cover the performance of a few C-D capacitor installations that have been in continuous operation for over a decade. They are indicative of the world-wide dependable service records established by C-D capacitors for utility and industrial power-factor correction, service voltage stability and over-load relief. In each case, the record is one of service year after year, with little or no maintenance — a real tribute to the rugged money-saving dependability of the Cornell-Dubilier capacitor.







FOR POWER-FACTOR IMPROVEMENT

HERE'S *WHY* C-D'S mean more value for your capacitor dollar!

Solderless service connector — A C-D Exclusive! Easy to replace. No danger of stripping or distorting the bushing stud and thereby ruining an otherwise perfect capacitor.

Bushing assembly rigidly secured by 7/16" Brass Stud — designed to withstand heavy service abuse.

Dykanol-filled bushing increases accepted flash-over safety factor. Insures high level of impulse withstand.

Heavy-duty, multi-petticoat, wet process, glazed porcelain bushing. Longer creepage path, less breakage hazard, high impulse rating.

Embossed, rigid cover prevents flexing and stress on bushing. Provides water shed.

Bushing designed to prevent gasket deformation. Assures permanent hermetic seal of unit.

Varnished double cork gaskets. Provide high pressure seal between bushing and case.

Discharge resistors — safeguard linemen by reducing residual charge to less than 50 volts in 5 minutes.

Terminal discharge resistor connected to each series section, instead of terminal to terminal. Provides effective discharge for each series group and balanced voltage distribution.

C-D capacitors are equipped with current-limiting fuses with high interrupting capacity

Capacitor stack hermetically sealed in container.

Sturdy steel tension equalizing band and rigid end plates. Insure uniform distribution of stack-pressure, still further increasing dependability of unit.

Wide margin maintained between paper and foil coordinated with major insulation to provide highest impulse level.

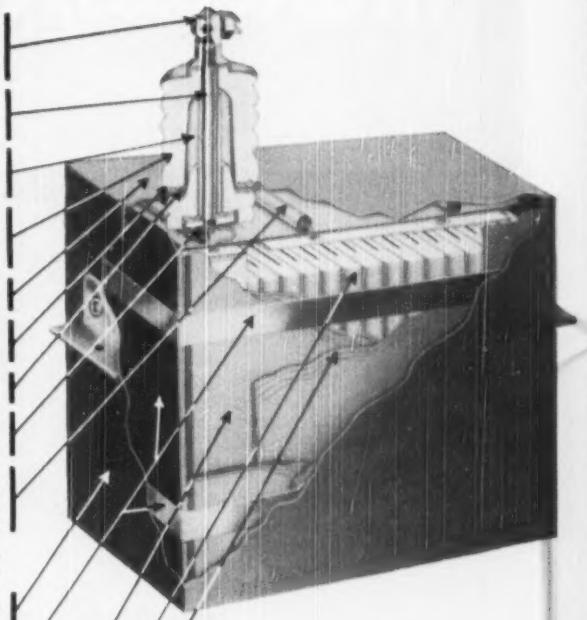
Impregnated and submerged in special non-inflammable, non-explosive Dykanol. Results in lower unit weight per Kvar; high stability; long life; less hazard to accessory equipment.

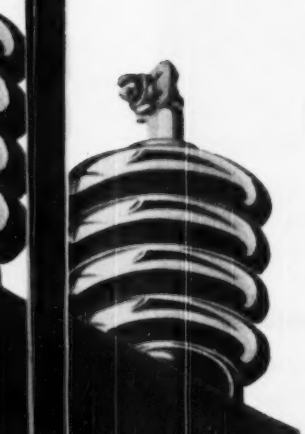
Many small sections in series parallel connection. Extremely low voltage gradient per section; less heating; no corona; longer life; lower power-factor; lowest dielectric unit stress.

Laminated insulation between case and sections. Insures high safety-factor for test and transient voltages.

Wrap-around bracket — another C-D exclusive! Two wraps extending around sides affording greater safety against impact stress in shipping and handling. That's why C-D racks can be shipped completely assembled, ready for energizing.

All C-D capacitors (from 230 to 13,800 volts), are given an energization test as a form of quality control by applying full rated voltage for minimum period of time sufficient to establish ultimate heat rise. (Only C-D capacitors give you energization tested capacitors!)





Among the many reasons why C-D industrial, station and pole type capacitors have given so many years of trouble-free service under the severest operating conditions is C-D's engineering standard which provides for the lowest dielectric unit stress and highest major insulation level. C-D station-type capacitors can be provided in weatherproof housings, switched or unswitched and completely assembled for energizing at field site, to meet specific sub-station needs. *Your inquiries are cordially invited. Our field engineers will be glad to discuss the many dollar and maintenance saving characteristics of these installations.*

CORNELL-DUBILIER ELECTRIC CORPORATION,
Dept. D-110, South Plainfield, New Jersey.

Other plants in New Bedford, Worcester and Brookline, Mass.; Providence, R. I.; Indianapolis, Ind., and Cleveland, Ohio.

CORNELL-DUBILIER

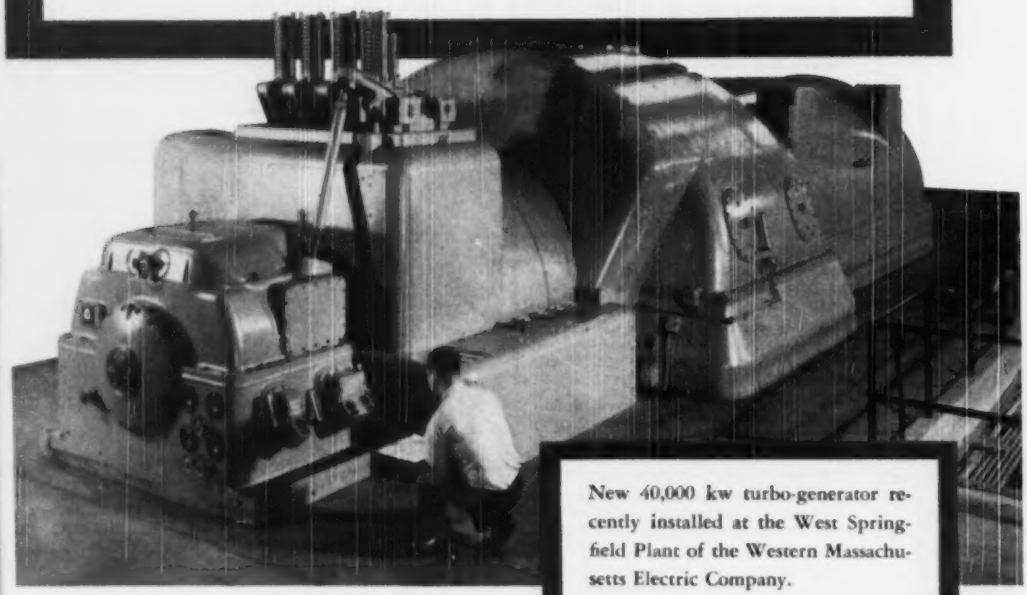
CAPACITORS

BEST BY FIELD TEST

Gulfcrest Oil *selected*

for another big turbine —

40,000 kw



New 40,000 kw turbo-generator recently installed at the West Springfield Plant of the Western Massachusetts Electric Company.

Another big turbine gets the safe, sure, long-lasting protection of Gulfcrest, the world's finest turbine oil!

Another case, too, where outstanding performance in other turbines operated by the same utility led to the selection of Gulfcrest Oil for the new unit!

Extra refining makes the difference! After the carefully selected crude oil used in Gulfcrest goes through the major refining methods, it is then supperrefined by the Alchlor Process.

As much as 15 per cent of the oil is discarded by the Alchlor Process — this 15 per cent contains the hydrocarbons most apt to oxidize and form sludge, emulsifiers, and harmful acids.

That's why Gulfcrest is incomparably pure — why it gives outstanding performance, and lasts indefinitely. Call in a Gulf Lubrication Engineer today for complete information on this superior oil. Write, wire or phone your nearest Gulf office.

Gulf Oil Corporation · Gulf Refining Company

GULF BUILDING, PITTSBURGH, PA.

Sales Offices - Warehouses

Located in principal cities and towns throughout Gulf's marketing territory

GULF INDUSTRIAL LUBRICATION

2 Good Reasons...

...for using IRVINGTON #32 RED INSULATING ENAMEL

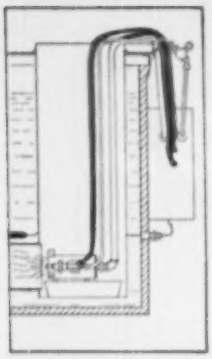
1 **It saves money** *because it costs less!*

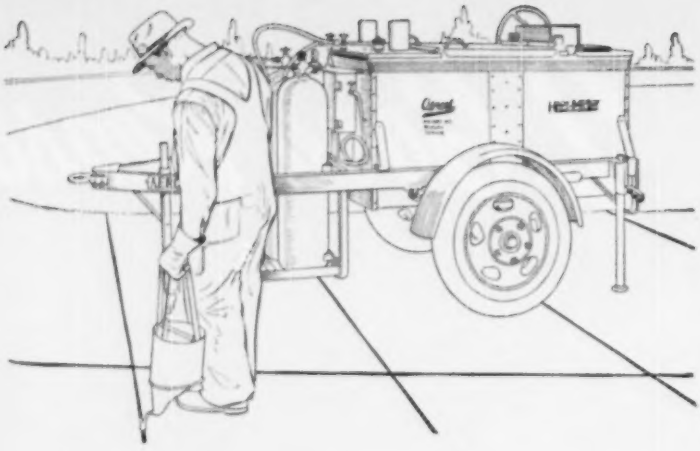
2 **It saves money** *because it dries fast!*

Look to Irvington **for insulation leadership**

Now you can save time, save money, on every electrical finish-enamel job. With Irvington's new #32 Red Oilproof Insulating Enamel, you get new speed of drying, new low cost. And you also get the bonus protection of a tough, impervious, 800 volt-per-mil insulation. Write today for technical data and samples.

IRVINGTON VARNISH & INSULATOR COMPANY
6 Argyle Terrace, Irvington 11, New Jersey





"Hot Stuff" puts the Heat on this Electrical Insulation

Joint sealing in concrete highway construction is an important operation, and must meet certain standards. Asphalt compounds used for joint sealing are properly heated and melted in specially-constructed, gas-fired kettles. During certain periods, the heating and melting kettle must run continuously for several days. Temperatures within the heating unit run as high as 450°F. Liquidified petroleum gas lines and thermostatic control lines in the unit must be insulated against open flame which could cause serious fire and damage.

BH Fiberglas Sleeving is used inside the burner wells of the Aeroil #120 DVP "Heet-Master" Double Vat Kettle because it meets a specific insulation requirement fully and completely.

"BH Fiberglas Sleeving is used inside the burner wells (see sectional view above) to protect the LPG gas lines and thermostatic control lines against very high temperatures and open flames from the gas-fired torches. It affords complete protection and plays a very important part in the efficient, breakdown-free operation of this equipment."

BH Fiberglas Sleeving is as flexible as string because no hardening varnish or lacquer is used. It is heat resistant to 1200°F, if required. Won't split, crack or deteriorate. Resists grease, oils, and moisture. Use it profitably in your product or in your plant equipment. Write us today about your insulation problems.

BENTLEY, HARRIS MFG. CO., CONSHOHOCKEN, PA.

BH Fiberglas* SLEEVINGS

*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393503). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.

USE COUPON NOW

Bentley, Harris Mfg. Co., Dept. W-45, Conshohocken, Pa.

I am interested in BH Non-Fraying Fiberglas Sleeving _____ for _____ (size or I.D.) _____ (product) operating at temperatures of ____°F. at ____ volts. Send samples so I can see how BH Fiberglas Sleeving stays flexible as string, will not crack when bent.

NAME _____ COMPANY _____

ADDRESS _____

Send samples, pamphlet and prices on other BH Products as follows:

☐ Cotton or Rayon-base Sleeving and Tubing

☐ BH "649" Fiberglas Tubing and Sleeving

Load-balancing is important to Hotpoint, too!*

Industry figures indicate BIG potential for these low saturation appliances

*Dishwasher and Disposall® Saturation: less than **2%**

*Food Freezer Saturation: less than **5%**

*Automatic Clothes Dryer Saturation: less than **1%**

*Rotary Ironer Saturation: less than **9%**

*Automatic Clothes Washer Saturation: less than **10%**

* **HOTPOINT Offers Utilities Future Load Insurance with its Development of all Major Appliances for Tomorrow's All-Electric Home**

In addition to a vigorous promotion behind today's established major appliances, Hotpoint has an eye to the future . . . to the day when wider usage of electric appliances now in the introductory stage will be needed to balance load for the utilities. Hotpoint is moving forward with a great building and sales promotional campaign to develop greater acceptance for the appliances now in the low saturation stage.

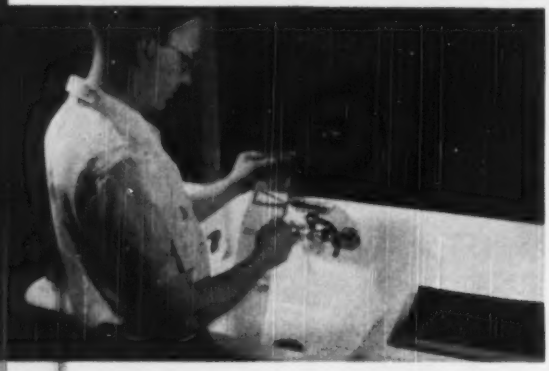
UTILITY DIVISION

Hotpoint Inc.

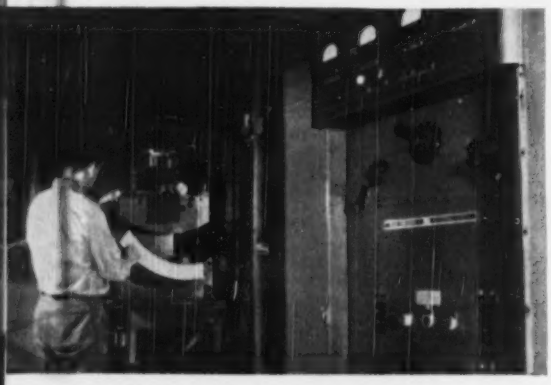
(A General Electric Affiliate)

5600 West Taylor Street, Chicago 44, Illinois

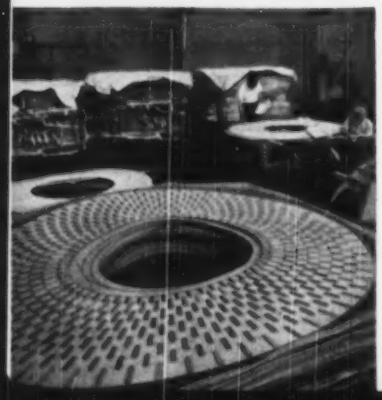
CORONA-FREE DESIGN KEEPS TRANSFORMERS YOUNG



1 **J. H. MORAN CHECKS** oscillogram after impulse test on the 40,000 kva transformer. Cathode ray oscillograph spots slightest trace of corona . . . yet even five times normal voltage showed no detectable corona discharge.



2 **DIELECTRIC HEATER** quickly dries fuller board insulation as it is pressed into accurate shape. Snug fit around coils and conductors eliminates air pockets and replaces free space with corona-resisting material in critical areas.



3 **PROPERLY DESIGNED** insulation raises corona and breakdown levels. This assembly floor scene shows fuller board washers and coils made up in pairs. Static shields at left center help transformers withstand high stresses.

Surge Protected Transformers for Philadelphia Electric Co. Will Retain Full Impulse Strength After Years of Use

WHY DO TRANSFORMERS fail? One important cause is corona discharge. Corona eats at transformer insulation, scoring it, making it electrically conducting. As a result, reduced transformer impulse strength causes dangerous flashover.

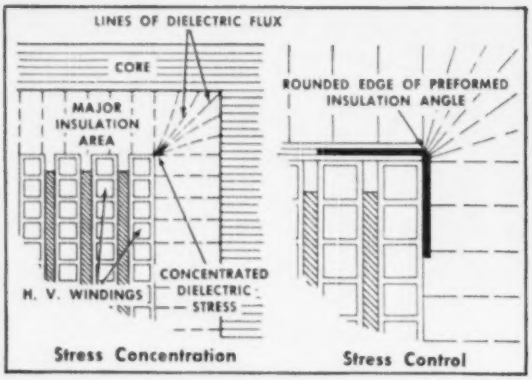
Allis-Chalmers corona-free design removes effects of corona.

How was it done? By designing dielectric shields on contacts to reduce flux concentration. By improving insulating materials and properly contouring press-molded fuller board. Corona-resisting material is inserted in critical areas next to high voltage conductors. Calculating boards are used to make windings corona-free at maximum voltage conditions.

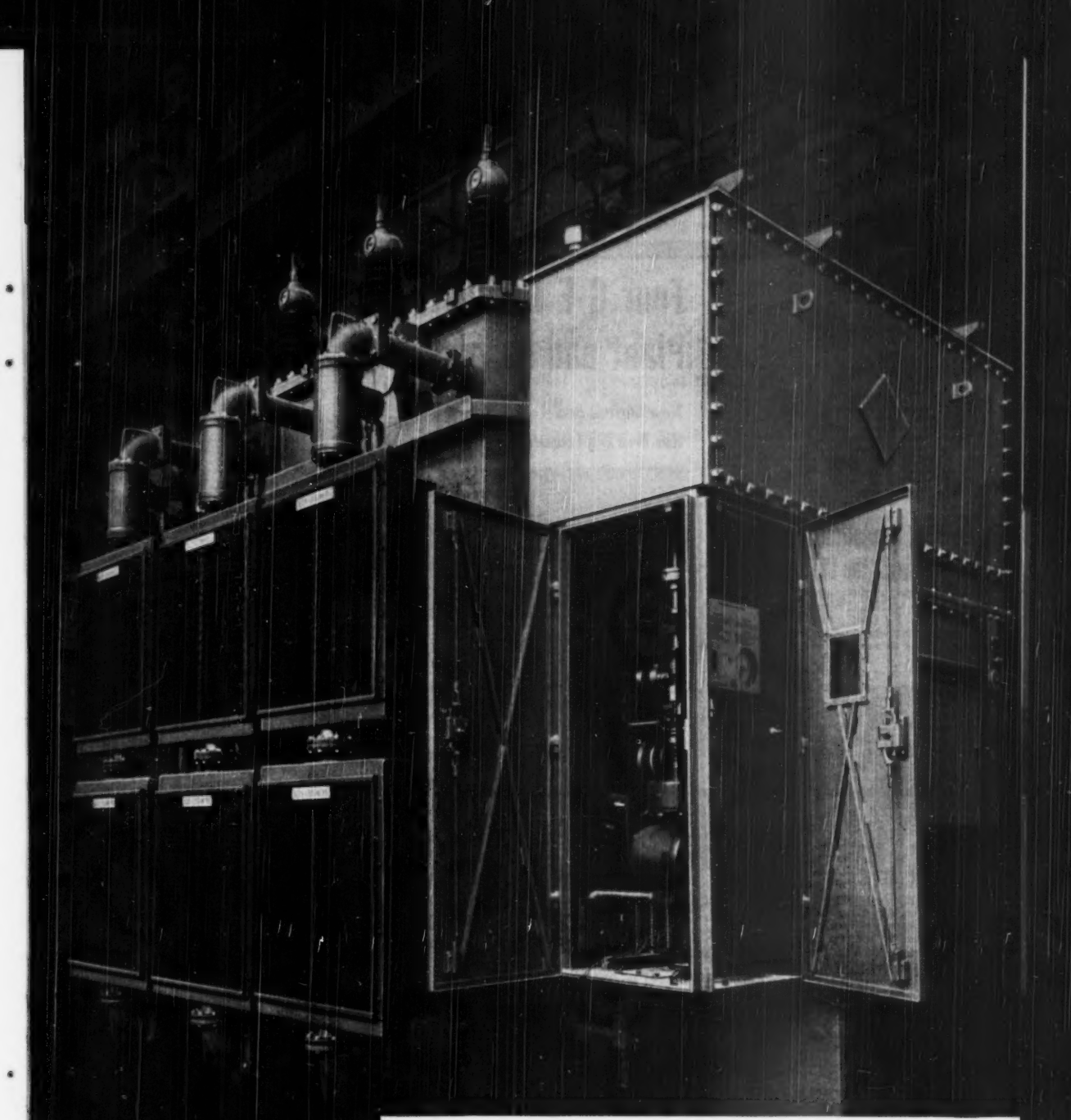
Did these design changes pay off? Tests show that transformers with corona-free construction stand up after repeated surges without slightest signs of deterioration.

Today you can obtain the kind of transformer that maintains its full strength . . . one that will last for years without growing old. A-3210

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.



4 **PRINCIPLE OF FITTING** insulation right up next to areas of high dielectric stress, then reducing stress per unit area with rounded surfaces, is one of the methods used by Allis-Chalmers engineers to cut corona discharge.



ALLIS-CHALMERS

5 BUILT FOR LONG LIFE this 40,000 kva forced-oil-cooled power transformer is rated 69,000 volts delta, 36,750 volts grounded Y, with plus and minus 15% regulation in neutral using type TLB load ratio control. The electro-cooler is completely self-contained with two power sources for pump and fan.

WIRING NEWS

Hint for power salesman

Practical tip for installation, maintenance, and operation personnel

A PERIODICAL DIGEST OF WIRING IDEAS FROM THE GENERAL ELECTRIC CONSTRUCTION MATERIALS DEPARTMENT

Enlarged section of special, untreated cotton cloth used in the manufacture of G-E No. 1799 varnished-cambric insulation for G-E power cables. Note large holes that assure maximum varnish absorption.

Quality Insulation Begins with the Cloth!

That's right, in the manufacture of General Electric No. 1799 varnished-cambric insulation for G-E power cables, only a selected, untreated cotton cloth is used. Woven to exacting General Electric standards, it absorbs and retains a greater amount of our own tough, flexible varnish than ordinary cloth. The result — after carefully controlled baking processes — is an insulation high in dielectric strength, stubbornly resistant to extremes of operating temperature, and uniform in thickness and strength.

Even though subjected to continued high conductor temperatures, General Electric varnished-cambric remains completely pliable.

In one test, a cable insulated with No. 1799 varnished-cambric, after more than 400 hours in an oven at 125 C, is bent around a ⅛"-diameter mandrel without damage to the insulation.

G-E varnished-cambric cables are available in three basic types:

BRAIDED — for power and control circuits, exposed or installed in conduit in dry locations; and for transformer and apparatus power leads.

INTERLOCKED-ARMOR — for overhead distribution in power plants and factories. This cable requires no raceways, permits speedy installations.

LEADED — for generator leads and power wiring in conduit or in underground ducts.

For information on any type in the complete line of G-E varnished-cambric cables, check box (A) in coupon.

Four G-E Products Improve Plant and Residential Wiring Systems

New Switch Box Has Five Big Features

Featuring a redesigned side-plate locking arrangement, this new General Electric switch box simplifies both the installation and ganging of boxes on any job.

New side-plate wedging action locks side-plates securely in position. Box sides cannot be dislodged by hammer blows while the box is being mounted or during scribing for lath cut-outs.

In addition to side-plate nail holes for easy gang mounting, a set of nail-through holes allows speedy mounting of *entire box* direct to studding. Merely drive home two 10d nails and you're ready to wire. There's no disassembly of side sections . . . no interference with knockouts . . . no clearance problems on any standard device.

Four contact points instead of three eliminate rocking or tilting of box during installation. Special side pry-outs provide for out-of-the-ordinary installations. All pry-outs are easily removable with a simple twist of a screwdriver blade.

A new single-screw ear for faster adjustments provides an added feature. A heavier bridge across ears gives increased support.

The new General Electric switch boxes are easily gangable and may be used with old type boxes on new construction or on modernization jobs. Get complete information on *all* their time-saving features—just check box (B) in coupon.

G-E Devices Keep Pace With Increased Loads

General Electric offers you up-to-the-minute wiring devices for circuits that supply current to motors, appliances, and motor-driven tools.

Heavy-Duty Switches

Smooth, reliable control of 125- or 250-volt circuits presents no problems when you use the new General Electric heavy-duty switch. Designed for 20- and 30-ampere operation, these T-rated, specification-grade units offer new improvements for faster, easier installations.

The switch is completely enclosed in a plastic housing for total protection from foreign particles during installation operations and is of shallow construction to provide ample wiring space in standard switch boxes.

Back-wired pressure terminals on the switch eliminate necessity of looping wires. Wires go in straight and are held firmly in place by pressure connectors.

For further information on General Electric's complete line of long-lived, heavy-duty switches, check box (D).

New Grounding Outlets

New grounding outlets and plugs meet the need for devices to conform to NEC or other applicable codes requiring grounding of portable electrical equipment. The outlet will accommodate any two-prong standard parallel-blade plug cap and will also take the special three-pole grounding cap. It is back-wired for easy installation and has two grounding terminals so that ground wires may be carried easily from one outlet to another. Pressure terminals accommodate two wires for easy wiring. In addition, ground contacts are also connected to washer-type plaster ears. Check box (C) for further information.

Quick-change Fuses

You'll find General Electric time-delay fuses are real time savers. Available in both ferrule and knife-blade types, they are easily renewable. Simply unscrew cap . . . insert new, self-aligning link . . . and replace cap. G-E time-delay fuses give quick positive protection against dangerous overloads — yet limited transient overloads won't cause unnecessary "blows". Check box (E) for information.

Section K10-1127

Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut

- ☐ A—Varnished-cambric Cables
- ☐ B—New Switch Box
- ☐ C—New Grounding Outlet
- ☐ D—Heavy-duty Switches
- ☐ E—Time-delay Fuses

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

GENERAL ELECTRIC

An Open Letter to all users of Utility Bodies

During a national emergency our company is faced with many additional problems. Supplies are scarce, customers requirements are greater, and in addition we have the responsibility of supplying materials for our fighting forces. Although the future is indefinite, our company has made certain plans . . . and we feel that the utility companies are entitled to know how we have been affected to date and what we are planning ahead.

Serves Only Utility Companies

The J. H. Holan Corporation was organized with the express purpose of supplying the utility industry with bodies and allied equipment. We serve only the utility companies . . . do not divide our attention between two or more industries. We acknowledge a debt to those companies who are responsible for our rapid growth, and they deserve every consideration in any allocation of our services should it become necessary.

Military Requirements

We will extend whatever manufacturing priorities are required to serve government orders which our company will be called upon to process during this partial mobilization stage. It is our intention to render this service with a minimum of interference to our essential utility business.

Supplies Are Scarce

The problem of supplies is a serious one. Materials are hard to obtain and under the new government priority system probably will get worse. Our suppliers have been co-operative. Still they are having difficulty holding their delivery promises and price lines, which directly affects the delivery of equipment to our customers. It will be necessary for us to keep our prices in line with the increased material and labor costs.

Increased Plant Capacity and Facilities

Every effort is being made to increase our service. An addition to our plant, which will increase production capacity approximately 50%, is almost completed. This will allow us to step up delivery of new equipment and expand our replacement parts service. New plant equipment will rectify many of the production problems which have slowed our delivery of special equipment. Our engineering department has been expanded with the express purpose of offering the industry many improved features and outstanding developments.

We Invite Your Inquiries

We believe our company is in a better position than ever to serve the utility companies. We invite your inquiries. You can be sure they will receive our immediate attention and every effort will be made to give prompt delivery of all types of Holan utility equipment.

J. H. HOLAN CORPORATION

J. H. HOLAN CORPORATION

Compare for Quality and Engineered Features

4100 West 150th Street, Cleveland 11, Ohio

DISTRICT SALES REPRESENTATIVES

6-03 161st St.
Beechhurst
Queens, N. Y.

611 Laura Ave.
Peoria, Ill.

DISTRIBUTORS

Baker Equipment Engineering Co.
Summit and Norfolk Streets
Richmond, Virginia

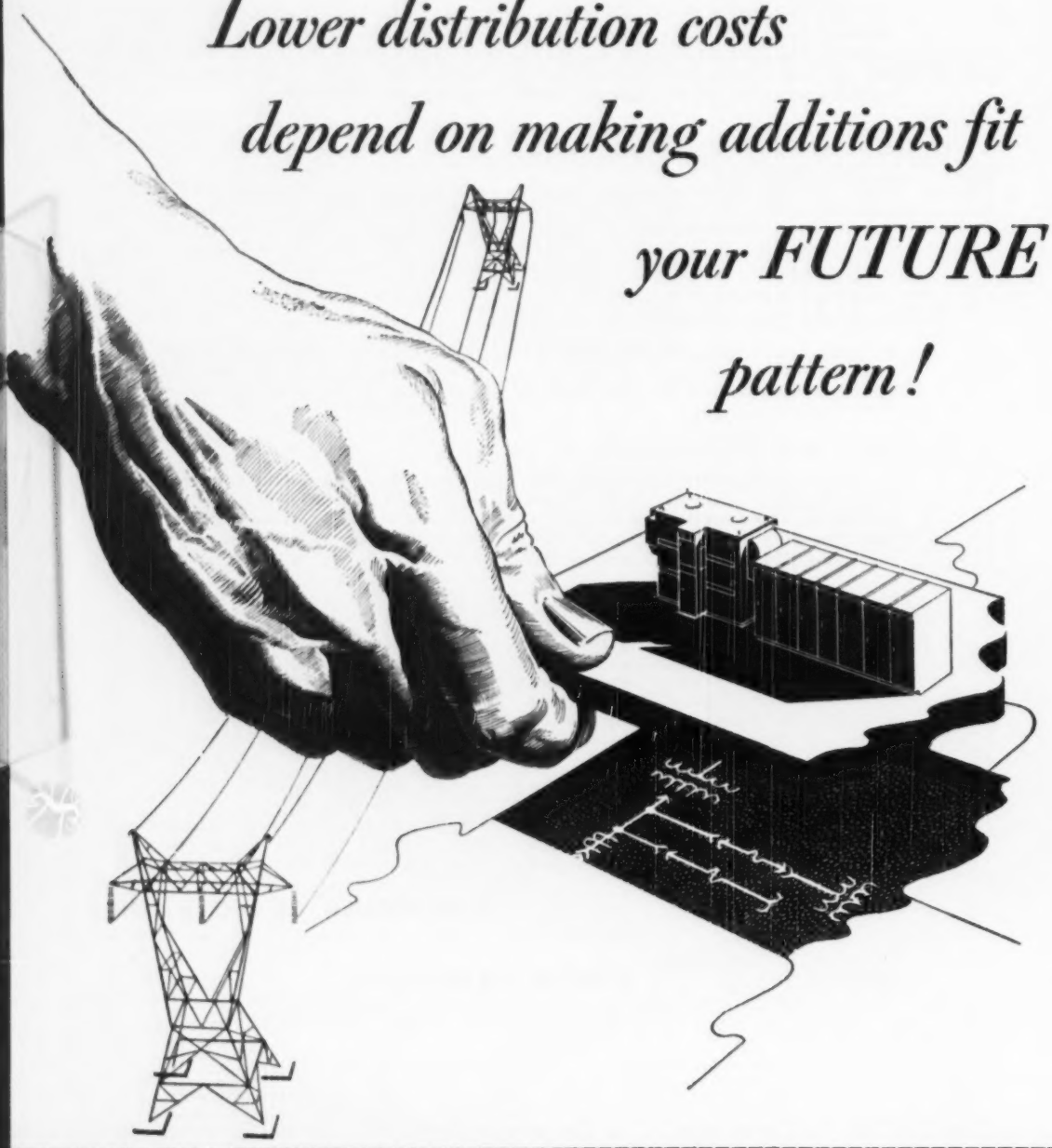
2401 Hutchinson Avenue
Charlotte, N. C.

A. & A. Supply Company
P. O. Box 769
Abilene, Texas

P. O. Box 1516
Albuquerque, N. M.

Roots & Schetky, Inc.
1810 S. E. 10th Avenue
Portland 14, Oregon

Lower distribution costs depend on making additions fit your FUTURE pattern!



YOU CAN BE **SURE**.. IF IT'S

Westinghouse

THIS single factor should govern your choice of equipment today! *For only by making today's expansion or replacements part of a preconceived future system can you hope to handle tomorrow's loads economically.*

The type of system you plan for will naturally depend on many factors. But far-sighted system planners agree that it should have one important characteristic: *Simplicity!* They point to loop or radial subtransmission patterns as logical goals, for the inherent simplicity of these systems promises handsome savings in distribution costs. Complex interconnections which pose problems of relaying are eliminated. The cost of equipment needed at numerous system tie-points is saved. Maintenance costs are less.

Simplified subtransmission also paves the way for further system simplification. Spot and secondary networks, and the use of banked secondaries represent typical opportunities for combining simplicity with improved service at lower cost. But remember . . . the equipment you choose today *must* bear a relationship to the system you plan for tomorrow. Recognition of this fact explains today's trend to *standardized factory-assembled substations* which provide for less costly bus regulation . . . utilize less costly equipment and give you the flexibility necessary to handle any distribution need.

These are helpful guides to modern system planning. But let Westinghouse help with your problem. Our engineers and complete system planning facilities are at your service. Call your Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.
J-97147

WRITE FOR A PRESENTATION OF THIS VALUABLE INFORMATION

"Electric Utility Power Distribution Systems", B-3903
"Co-ordinated Substations", B-4061
"The A-C Secondary Network System", B-4002-A

Westinghouse

SYSTEM PLANNING SERVICE

High-Accuracy Beckman pH Meter† relies on D-H ALLOYS

FLOW CHAMBER — with resistance bulb thermometer and electrodes.
BECKMAN MODEL R pH INDICATOR containing amplifier and precision measuring circuits.

In large industrial installations, where pH control must be continuous or automatic, or both, the temperature of process solutions has to be obtained continuously, in order to compensate for effects of temperature change upon pH.

To accomplish this, the Beckman Model R Automatic pH Indicator provides a flow chamber, or immersion assembly, containing a resistance bulb thermometer in addition to the glass and calomel electrodes used in measuring pH. This resistance thermometer is an element in the feed-back circuit of a stable DC amplifier whose sensitivity is accordingly varied in proportion to the absolute temperature of the process solution.

To assure complete accuracy, the thermometer of the Beckman Model R pH Indicator is wound with D-H HYTEMCO* wire, supplemented with D-H MANGANIN. The high temperature coefficient of HYTEMCO makes it eminently suitable for this application; and the absolutely uniform behavior of this alloy, thruout a wide temperature range, helps the indicator to record pH values with utmost fidelity. The supplementary winding of D-H MANGANIN is required in order to raise the resistance of the assembly to a specific circuit value without increasing the increment of resistance with temperature. This the MANGANIN does very effectively.

RESISTANCE BULB THERMOMETER — Sufficient Hytemco wire is used to obtain the necessary resistance value for the temperature range. A small percentage of Manganin is then added to bring total resistance of winding up to circuit requirements.

In addition to the desirable electrical characteristics of these D-H alloys, however, is the outstanding uniformity of the wire from spool to spool, and the quality "built into" it —as a result of exclusive Driver-Harris know-how and advanced melting, rolling and drawing techniques.

Special alloys for special uses is an important phase of our business. If you have been unable to obtain just what you are looking for, let us know your requirements. We'll gladly put our 50 years of experience at your disposal, and supply you with the alloy best suited to your needs.

†Product of National Technical Laboratories, S. Pasadena, Calif.

Makers of world-famous Nichrome and over 80 alloys for the electrical, electronic and heat-treating fields*

Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco

Manufactured and sold in Canada by
The B. GREENING WIRE COMPANY, LTD., Hamilton, Ontario, Canada

FIFTIETH ANNIVERSARY — SPECIAL PURPOSE ALLOYS SINCE 1900 — D/H — TRADE MARK REG. U. S. PAT. OFF.

*T. M. Reg. U. S. Pat. Off.

McGUIRE MOTOR CO.
Detroit, Michigan

Architect
Edward Fisler, Detroit

Fixture Manufacturer
The Kirlin Co., Detroit

Electrical Contractor
Casey Electric Co., Detroit

Engineer
Roy W. Covey, Detroit

Glass
Corning ALBA-LITE

For Lighting That Sells— Use CORNING ALBA-LITE

Here is a showroom lighting installation that is truly unique. With a light intensity of 82 foot candles and fixtures in an unusual radial pattern, it stands out day and night. To achieve this customer-attracting effect, Corning ALBA-LITE was specified.

Despite the high level of illumination in this installation, ALBA-LITE produces comfortable levels of panel brightness. Its non color selective properties assure that finishes are shown to best advantage. Even unlighted, the soft opal of ALBA-LITE presents an attractive appearance.

With an efficiency of over 90%, ALBA-LITE gives you maximum light transmission thereby reducing wattage requirements. Its smooth surface makes cleaning easy—keeps maintenance costs low. ALBA-LITE will not warp or sag in fixture frames and color transmission always remains true.

Available either flat or bent ALBA-LITE may be used for direct, semi-direct, semi-indirect and completely luminous ceiling. For complete information send for Bulletin LS-17.

CORNING GLASS WORKS
CORNING, NEW YORK
Corning means research in Glass

FOR EFFICIENT, ATTRACTIVE LIGHTING...

CORNING ALBA-LITE for diffusion of fluorescent light ... CORNING FOTA-LITE for high level illumination ... CORNING brand LENS PANELS and PYREX brand LENSLITES for prismatic light control

CORNING GLASS WORKS
Dept. EW-11, Corning, N. Y.

Please send me a free copy of your Bulletin LS-17 describing Corning ALBA-LITE.

Name _____ Title _____

Firm _____

Address _____

City _____ Zone _____ State _____

Puzzle for experts

There is no need for "cutting and trying" on the job to make a prefabricated piping sub-assembly fit perfectly. Prefabricated miles away to exact dimensions and specifications these pieces of piping are links in piping systems which may carry steam up to 2500 p.s.i. and 1050°F.

Grinnell integrates the many factors in this complex, highly technical assignment in one organization of specialists. Major economies result from this single responsibility which includes interpretative engineering, metallurgical research, compliance with code requirements, manufacturing drawings and specifications, production schedules, purchase of materials, specialized facilities, skilled personnel, control of quality and rigid inspection.

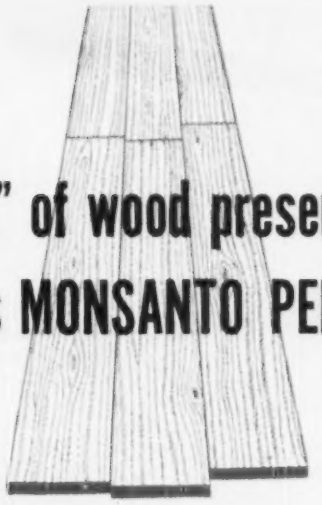
You'll find it to your own best interests to draw upon Grinnell's century-long, specialized experience in power, process and industrial piping.

GRINNELL

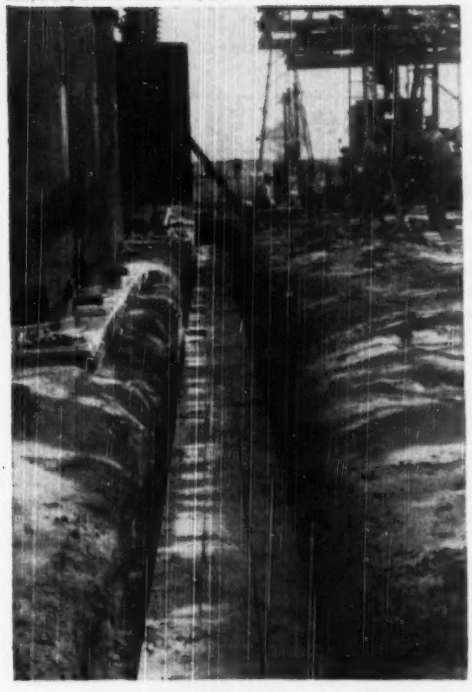
Grinnell Company, Inc., Providence, R. I. Branches: Atlanta • Billings • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

for "tough job" of wood preserving, utility chooses MONSANTO PENTAchlorophenol

(Santophen 20)



MONSANTO PENTA protects planks which protect workmen and cables at this Union Electric Company of Missouri substation, near St. Louis.



There was a "tough job" for a wood preservative when Union Electric Company of Missouri built safety for workmen and protection for cables into its new substation at St. Louis. To accomplish this built-in protection, underground conduits were covered with heavy planks so that future workmen would not pierce cables accidentally. Obviously, to give *long-lasting* protection, the planks had to be treated with a *long-lasting* preservative. Monsanto PENTAchlorophenol was applied by pressure process at the rate of 10 pounds per cubic foot of wood.

Monsanto PENTA is a *chemically uniform* material. It *stays* in the wood . . . does not evaporate . . . isn't washed away by rain or ground water. Monsanto PENTA gives *positive protection* against termites and other wood-destroying insects . . . against rot organisms. With properly formulated PENTA treatment, wood can be painted or stained. It can be made water repellent.

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YET IT COSTS NO MORE THAN ITS 50-AMP PREDECESSOR

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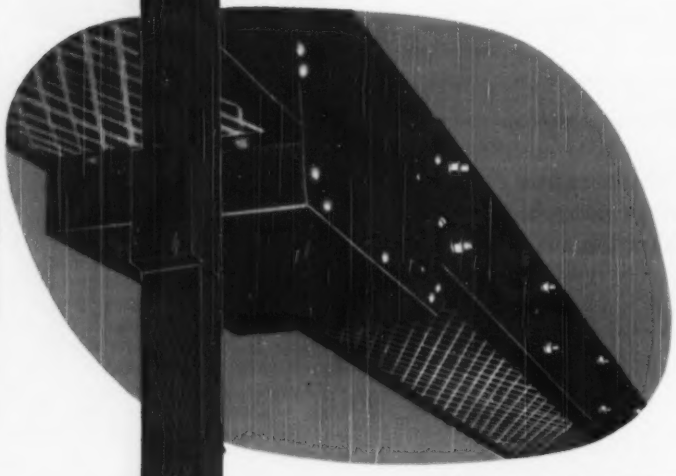

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Will Election Results Help Private Power?

No matter which party wins control of the Congress, or even of the Presidency, some governmental activities in the electric power field will go forward. These include hydro electric projects, REA loans, and rather strict regulation of power companies.

But many factors in the results of the election just past indicate that new opportunities are presented to save more of the electric power industry for private operation than seemed possible before the election. There will be more men in the 82nd Congress who can be depended on to assist in the preservation of private enterprise. The Fair Dealer ranks have been thinned by the defeats of such Administration stalwarts as Tydings, Lucas, Pepper, Graham, Douglas.

Men like Taft, Dewey, Warren, Duff, and Dirksen have so strengthened themselves that they can be depended upon to wield wider influence than ever before. It is quite significant that Dewey has interpreted the election results as being, "Notice by the people of New York that we want the right to develop our water power at the St. Lawrence and Niagara Rivers, we want the Washington Administration to get out of our way." He went further by saying, "We demand the right to go ahead and develop cheap electric power for all the people of New York." A liberal interpretation of this statement would lead one to believe that Dewey will use the only possible means of giving the benefits of cheap power to "all the people" by permitting the private companies to participate in its distribution.

It is also safe to say that the support given the Republican candidates reflected opposition to further socialistic schemes. It is only a matter of being sure that federal power expansion is clearly identified to each Congressman as falling in the category of socialism.

Another significant trend which may have far-reaching results can be discerned in the labor vote. Except for electrical and utility workers' unions who by record action favor private industry in the power business, labor bosses seem to be following the Truman line on federal power and valley authorities. But the fact that the labor vote in Ohio was contrary to the advice of the union leaders shows that workers are strong supporters of the American system as represented by Taft. It also means that they can be depended upon to back those whose ideas they respect rather than blindly following the labor bosses.

The election cannot be interpreted as a windfall for the private power industry. But it has created an environent in which substantial gains can be made if spokesmen for the electric utilities show the leadership that is essential. It will require an attitude of renewed determination rather than hopeful rejoicing.

Transformer Noise

Transformers are beginning to disturb the neighbors, and the potential situation warrants pause for concern especially on the part of utilities with substations in residential areas. At the moment the situation seems to be that there is no immediate escape in critical cases except by building sound-proofing enclosures around the substations.

Development of the unit-type substation, which made buildings virtually superfluous, offered excellent opportunity for saving in first cost and erection. Many such units are serving satisfactorily even in close proximity to the homes they serve. Matching progress was made in the neat fencing, shrubbing, and landscaping of the site, and they have been, as a result, accepted by the public as preferable to the often unsightly brick buildings of a former era.

Meanwhile, power transformers have been redesigned for better economy of iron and copper. Indirectly the general switch to cold-rolled laminations seems to be resulting in noisier units. What is thus being saved threatens now to be more than offset by the costs of the enclosures and the costs of exploring the field complaints. Actually a large portion of agitation seems to be unjustified, and unfortunately what suffices as a corrective in one location is comparatively ineffective in another.

The situation deserves more all-around technical attention than it is getting. Manufacturers are recognizing it as a No. 1 problem and are surveying their designs, fabrication processes, and assembly practices. Instrument manufacturers have a fine chance to improve the facility and reliability of acoustic measurements. Utilities must match these efforts with more careful preanalysis of sites, layout, comparative economics, and relative noiselessness of designs. Otherwise they will be paying a stiff penalty in land and walls for having tried to save by units with minimized amounts of critical materials.

Hardly any other conclusion can be reached on the basis of recent discussions admirably exemplified by Corbett McLean's article on Page 114 of this issue.

In France, Same as Here

"Before the war, the promotion of applications of electricity was highly regarded by most electric utilities and in various degrees each one devoted sustained effort to it. Specialized activities were organized, all possible means of publicity were employed, and intensive campaigns for sale of this or that apparatus were launched from time to time.

"It is undeniable that without this constant promotion certain applications of electricity now widespread would never have seen the light of day, or at least would never have been brought to their present development. The manufacturers, the sellers, and the installers of equipment often participated in this promotion, but it is a fact that utility activity predominated not only because the utilities were better able to finance sale of appliances but also because of the dynamic and enterprising commercial spirit that had been carefully developed and maintained in their sales organizations.

"But for ten years now that spirit has been asleep, and for reasons too well known."

The foregoing is a translation of the opening paragraphs of an article by Bernard Kuhn de Chizelle in the September issue of BIP, a French publication devoted to promotion of electric service. What these paragraphs say of conditions in France applies in only slightly less degree to the situation in our country. The commercial spirit of the electric utility industry was asleep here, too, and is not yet much farther than the eye-rubbing stage as it awakens. And we can echo the wish with which Mr Kuhn de Chizelle concludes his article:

"We wish strongly that the promotion we have described will rapidly regain its activity of other days, and that our commercial departments, having recovered all their confidence in the future, will give proof again of the spirit of enterprise that has always characterized our industry."

The Forelock of Opportunity

Just because a family unit moves from a lower to a higher income bracket, it does not follow that the standard of living of the family is correspondingly elevated immediately. Instead, it too often happens that the newly available money is spent extravagantly and without thought of the worthwhile improvement of living it could secure.

In an analysis of consumers' purchasing power by Arno H. Johnson of the J. Walter Thompson Co, it is pointed out that between 1941 and 1950 there were some very significant shifts upwards in the distribution of families by income groups. In 1941, 14 million families had incomes above $2,000; today the number is 35 million. As for the effect of income taxes, consider these figures. In 1941 only 5.7 million consumer units had incomes over $3,000 *before* taxes; now there are 21.3 million with incomes over $3,000 *after* taxes.

This movement of families into higher income brackets is continuing. Every wage rise, whether to one man or to thousands, gives it an upward nudge. Income taxes, no matter how heavy, will never catch up with it, never while politicians remain vote-conscious. And price increases lag behind the movement, too. Thus it is that the market for the better things of living, among which electric appliances stand high, keeps on growing larger. This is not a sellers' market, not for those products on which an improved living standard is firmly based, although it may be for luxury items. Nor is it a buyers' market in the sense of price consciousness. It is simply a market waiting to be sold, willing to buy when it is shown. It is opportunity, offering its forelock to any outstretched hand. Will the hand of the electrical industry be the one that takes firm hold?

The Electrical Week

IN WASHINGTON—The rightward political trend of the elections will be reflected in legislative actions by the 82nd Congress, but there will be surprisingly few new faces in legislative power parleys (p 96) . . . The Bureau of Reclamation has signed the first power contract with a California irrigation district for delivery of Shasta Dam power (p 95) . . . Edward Falck has resigned as director of OEU. His successor is Maj Gen Everett S. Hughes, retired, a former Army Chief of Ordnance (p 95) . . . Northwestern Public Service Co has signed a contract with the Bureau of Reclamation for "wheeling" and purchasing federal power (p 98) . . . George W. Hamilton, consulting engineer, has been appointed a consultant on power supply to Secretary of Interior Chapman (p 101).

ELSEWHERE—Southern California Edison Co's vast postwar expansion program has been keeping the company two jumps ahead of the area's rapidly increasing population (p 94) . . . War is fed by the harvest of the civilian economy, A. G. Bur, Wisconsin Public Service Corp, told the Sales and Service Section of the Wisconsin Utilities Association Convention (p 97) . . . New and better public relations programs were stressed at the annual conference of the California Municipal Utilities Association (p 98) . . . Seattle voters apparently have rejected the purchase of Puget Sound Power & Light Co properties by the city (p 100) . . . And output is up to 6,574,084,000 kwhr—fifteenth record for the year (p 101).

• • •

There is a good possibility that some of the pro-public-power Fair Dealers who were defeated in the last election will still have a place in Washington. Truman has a habit of securing jobs for the "loyal."

Government planners have set up an allotment scheme for new aluminum expansion. It's to be split four ways: 30% Alcoa, 30% Kaiser, 30% Reynolds, 10% Harvey, Apex, and any others. The idea is to build up smaller producers in relation to Alcoa.

FPC Nov 8 approved plans of Northeastern Gas Transmission Co to serve portions of New England. At the same time, FPC told Algonquin Gas Transmission Co that it can get approval to serve other portions of the area when it has an adequate supply of gas.

Sales of electrical goods wholesalers dropped off 9% in September compared with August, but they were 39% above September 1949. Latest figures compiled by the Department of Commerce's Office of Business Economics showed sales for the first nine months of this year 23% over last year.

Latest EEI prediction is that for 1950 capability will reach 66,897,000 kw and peak load will be 59,761,000 kw. This will provide a reserve margin of 7,136,000 kw or 11.9%. EW figures indicate that these estimates are on the conservative side.

First atom-powered submarine—expected to boast the first practical atomic power plant—will cost $40 million, estimates General Electric's K. A. Kesselring, assistant head of the engineering division of the Knolls Atomic Power Laboratory.

Aluminum production reached its highest level in six years during the third quarter, but an industry official declared that supply is lagging behind demand.

Preliminary figures from the Federal Power Commission show that September energy sales were 24,750,078,000 kwhr, 15.8% higher than a year previously. By classification the sales in millions of kwhr were as follows: Residential 5,836, commercial 4,289, industrial 12,657, and other 1,967.

Add popular sports: Surveying New England. The latest survey is to be made by the National Planning Association's new 83-member committee of New England.

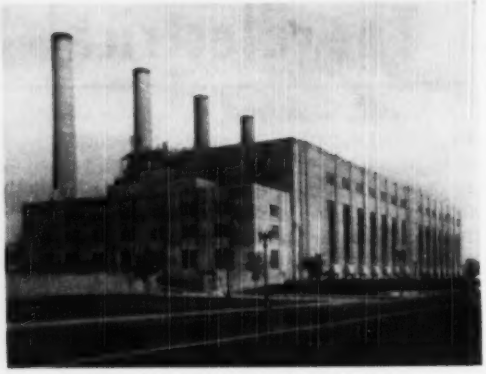
ECA has approved $330,000 for the purchase of diesel units to supply power in isolated villages in Vietnam, Indo-China.

General Electric would like another name for the heat pump. It has already considered 580 other names but rejected them all.

Notes From The News

The Electric Power Board of Chattanooga, the biggest distributor of energy produced by the Tennessee Valley Authority, purchased a record high of 103,076,000 kwhr in October . . . The two customers of Union Electric Co of Missouri in St. Louis who are using direct current will have to convert to ac. The company has received permission from the Missouri PSC to discontinue dc service by Sept 1, 1951 . . . Heavy rains have filled all power dams in the Northwest.

W. C. MULLENDORE, president, Southern California Edison Co, speaking at dedication ceremonies of Redondo Plant



COMPLETED in 1949 at a cost of $38,300,000, the plant contains four units with total capacity of 280,000 kw

Southern California Edison Growing

Vast Postwar Expansion Program Will Bring Capacity of Total System to 1,826,550 Kw by End of '51; Population Multiplying

Southern California Edison Co has been two jumps—not just one—ahead of Southern California's spectacular population growth.

In 1917 it took over all hydro development in the Big Creek-San Joaquin River area, near the crest of the High Sierra in Central California. Today, over some of the longest transmission lines in the United States, it draws power from 5 Big Creek hydro powerhouses, 248 miles north of Los Angeles. By the end of 1951, when the first 6 years of its post-war construction program are completed at an approximate cost of $300,000,000, the company will have added a sixth (Big Creek No. 4) powerhouse to its system and with it, an additional 84,000 kw. This ups the capacity of its total system to 1,826,550 kw.

Using the same water continuously through high static heads, Big Creek, into which Southern California Edison has poured $142,000,000 since 1913, generates more kwhr per unit of water than any other hydroelectric project in existence. Scheduled for completion this year are 133 miles of 230-kv transmission line; another 120 miles of 230-kv transmission line from Big Creek, ready by next year; and a 954-ft-long, 240-ft-high dam to store 35,000 acre ft of water for the Big Creek hydro plant scheduled for completion in mid-1951.

Today Big Creek is a composite of 3 major lakes, 12 major dams, 8 major tunnels, (Ward tunnel, completed in 1925, the project's most spectacular single job, is 15 ft in diameter and runs 13 miles through solid granite), and a series of 5 powerhouses utilizing water from a drainage area of approximately 1,050 sq mi in the High Sierra. "Big Creek" is the pride of Southern California Edison. Because of it, the company ranks second among the nation's utilities in hydro generation and fourth in hydro plant capacity.

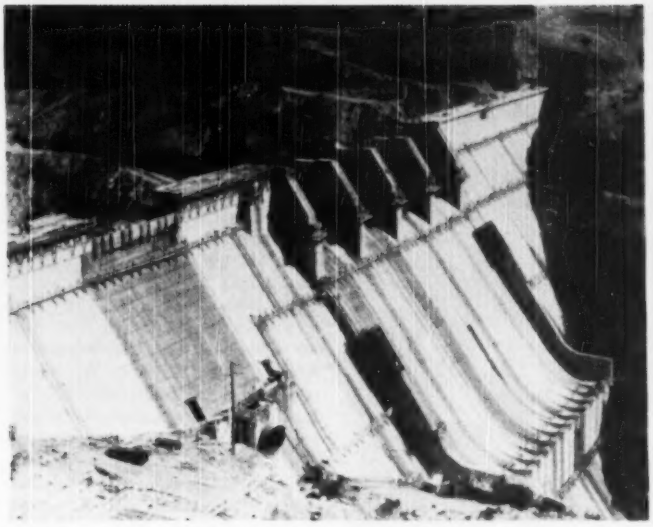
Monumental has been the growth of Southern California Edison's plant investment. As of Dec 31, 1949, it was $542,224,661. This shows an increase of 12% over the previous year, and a jump of 47% since the beginning of its postwar expansion program in 1946.

Already completed under this program is the company's 280,000-kw Redondo Steam Station, an additional 35,000-kw unit in Big Creek Powerhouse #3, and the addition of a 22,500-kw unit at Long Beach Steam Station. Projected is still another steam generating plant to be built near Fontana, with the first of two 100,000-kw units scheduled for completion in 1952.

Southern California Edison serves an area of 18,500 sq mi containing 890,592 customers. The population of this area has grown spectacularly since 1940, from 1,607,000 to 2,800,000 in 1950. In order to serve this fast-growing population and its industry, the company owns or leases and operates 24 hydro plants, 4 steam, and one diesel.

At present the total generating capacity of Southern California Edison is 1,742,550 kw. Of this, Big Creek supplies 430,000 kw. An additional 561,050 kw is contained in other hydro plants, including the Hoover Dam Plant on the Colorado River where 6 generating units are operated by the company. The balance— 751,500 kw —is contained in the fuel-electric system, which now consists of 3 steam plants at Long Beach, one at Redondo Beach, and a diesel plant at Vernon, Calif.

As of Dec 31, 1949, Southern California Edison had 38 transmission substations with an aggregate capacity of 4,185,350 kva and some 4,208 circuit mi of 33-kv to 230-kv transmission lines. Its distribution system extended into 10 of California's 58 counties and comprised 17,715 mi of over-



COMPANY'S DAM NO. 7 will be 950 ft long and 250 ft high. It will form storage reservoir of 35,000 acre ft to serve 6th powerhouse at Big Creek development

SCHOOL GIRLS receive electric cooking instruction in classrooms designed and equipped by the school advisory service of the Southern California Edison Co

head lines (excluding 1,058 mi of distribution lines on transmission poles); 213 mi of underground lines; and 283 distribution substations with an aggregate capacity of 2,630,232 kva. Ironic, however, is the fact that Los Angeles, the most fertile load-building area of all, is served by the city-owned electric utility, Los Angeles' Department of Water & Power.

The company's sales have jumped to extreme proportions since 1940. In that year, with a population of 1,566,708 in its area, it had 442,369 domestic customers. By 1950, with a population spurt of 73.6% (2,719,659), Southern California Edison has upped domestic customers by 63%—to a total of 729,249. There are 6,900 full-time employees, of whom approximately 4,250 are covered by contract with the IBEW.

Reclamation Approves Shasta Power Contract

The Bureau of Reclamation has signed the first power contract with a California irrigation district for delivery of Shasta Dam power. In order to serve the district a 4-mile line will be constructed from the bureau's 135,000-hp Tracy pumping plant, now nearing completion. Service is expected to start in mid-1951 when a 213-mile line from Shasta to Tracy pumping plant will be completed.

The contract is the R-2 PI type specifically adopted this year for irrigation and drainage pump customers. It will charge the irrigation district not less than 4 mills per kwhr nor more than 5 mills, with a 4.4 mill rate for 5 million kwhr. For the 12-month period ending last August the Pacific Gas & Electric Co had charged the district at an average of 8.7 mills for slightly more than 5 million kwhr.

PG&E is now paying the bureau 5.1 mills per kwhr for power delivered to the company at the dam.

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Edward Falck Resigns Post as Director of OEU

Edward Falck has resigned as director of the Office of Energy and Utilities of the National Security Resources Board. His successor is Maj Gen Everett S. Hughes, retired, a former Army Chief of Ordnance. Falck is expected to continue to serve as a consultant to NSRB Chairman W. Stuart Symington.

First director of OEU, Falck joined NSRB in 1948. He also heads Edward Falck & Co, a Washington utilities consulting firm. In World War II he served as director of the Office of War Utilities and previously had been with the Tennessee Valley Authority and Consolidated Edison Co.

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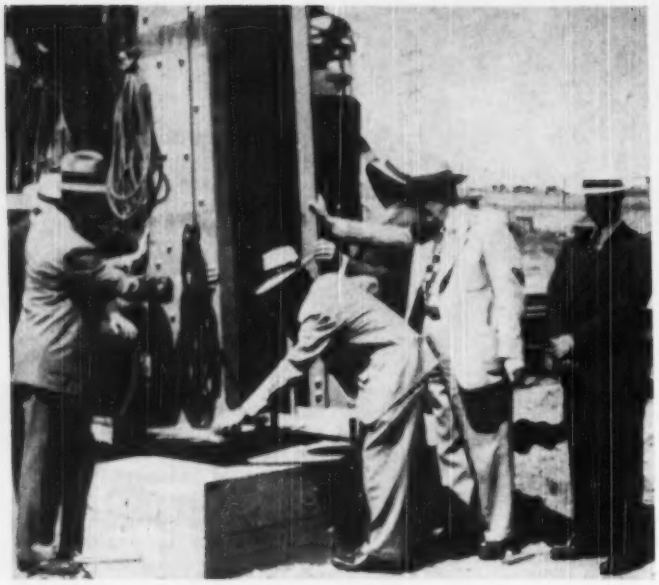
Recruiting British Workers

Two thousand British workers are being recruited by the Ontario Hydro-electric Commission to work on its projects. The men will be flown to Canada in groups of about 200 a month probably starting in January. The commission will lend them the money for the trip providing they remain on the job for about two years and agree to repay half of the sum advanced.



EXECUTIVES of the Public Service Co of Colorado all join together in order to swing into place the first steel column for the construction of a third 40,000-kw unit for the company's Arapahoe steam-generating plant. Left to right, Pres J. E. Loiseau, Vice Pres M. M. Koch, Vice Pres W. D. Virtue, and F. L. Witsell

Little Change Seen in Committees Controlling Power in 82nd Congress

The rightward political trend of the elections will be reflected in legislative actions by the 82nd Congress, but there will be surprisingly few new faces in legislative power parleys.

Control of Congress and leadership of committees remain with the Democrats. There is only a handful of important changes indicated for key posts on committees dealing with power policy and money.

Two significant changes were in the works before this month's balloting. Sen Elmer Thomas, Oklahoma Democrat who headed the Senate Agriculture and Forestry Committee which handles REA policy legislation, was defeated in the primary by Rep A. S. Mike Monroney, a staunch supporter of electric co-op activity.

Thomas played an important role in the 1949 Senate debate which was influential in the Department of Interior's decision to negotiate the contract with Oklahoma power companies for handling some of the output of federal power in the Southwest. His successor as Agriculture Committee chairman will be Sen Allen J. Ellender of Louisiana.

Chairman William M. Whittington, Mississippi, of the House Public Works Committee did not seek re-election. Democrat Charles A. Buckley of New York City will succeed him.

Upending of Democratic leadership in the Senate—by the defeats of Majority Leader Lucas in Illinois, Senate Whip Myers in Pennsylvania, and Senators Tydings of Maryland and Elbert Thomas of Utah—may indirectly spell power-important changes.

Interior Committee Chairman O'Mahoney of Wyoming is being prominently mentioned for party leadership in the Senate. Second ranking Democratic member, James E. Murray of Montana, will become chairman of the important Labor Committee, succeeding Elbert Thomas. California's Sen Sheridan Downey did not seek re-election; so the Interior chairmanship, if vacated by O'Mahoney, may fall to Arizona's Ernest W. McFarland. Another candidate for party leadership is Georgia's Richard B. Russell, who heads the agriculture subcommittee of the Senate's Appropriations Committee. He might relinquish this job if moved into another spot.

Re-elected to the Senate were several important power policy figures: Brien McMahon of Connecticut heads the Joint Committee on Atomic Energy; Alabama's Lister Hill was a sponsor of Rural Electrification loans for telephones; and Carl Hayden of Arizona is chairman of the Appropriation Committee's subcommittee on Interior, and a member of the subcommittees on appropriations for Army civil works and agriculture.

House Democratic committee leaders re-elected included: Chairman Clarence Cannon, Missouri, Appropriations Committee; John H. Kerr, North Carolina, chairman of the subcommittee on Army civil works appropriations; Michael J. Kirwan, Ohio, chairman of the Interior appropriations subcommittee; Jamie L. Whitten, Mississippi, chairman of the Agriculture appropriations subcommittee, and Harold D. Cooley, North Carolina, head of Agriculture Committee.

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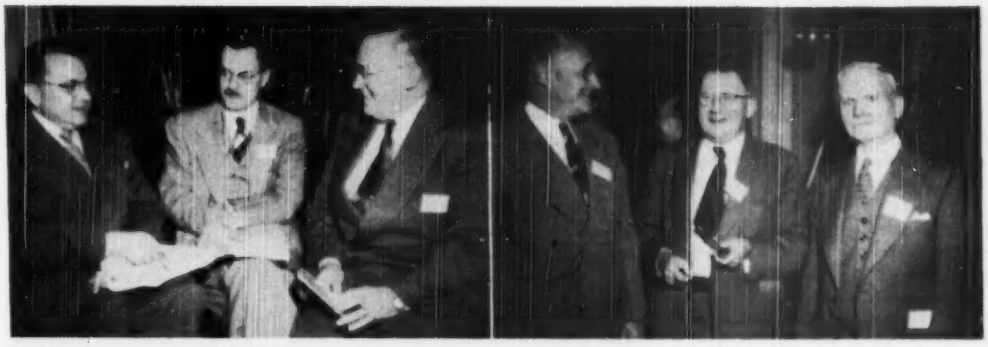
Coal Gasification Works at Alabama Power Mine

Gasification of coal at the Gorgas Mines of the Alabama Power Co has proved successful. The Bureau of Mines reports that it has been able to operate a 500-hp gas turbine solely on gases from burning coal. The turbine is being used to pump air to the coal burning in underground seams.

The experiments have been underway since 1948. Their purpose is to find a way in which coal in rocky seams that can't be reached economically by normal methods can be utilized.

Government experts estimate that there are millions of tons of such coal in the United States. If this coal can be burned underground and the gas brought to the surface, there are many uses for it. Such underground mining can be far less expensive than conventional methods. It is reported without confirmation that Russia has been burning coal underground for some years with success.



PARTICIPANTS on the Technical Section program were J. F. Roberts, left, Allis-Chalmers Manufacturing Co; M. G. Gorow, Wisconsin Michigan Power Co; and E. W. Hatz, Wisconsin Electric Power Co. In right panel C. A. Scarlott, Westinghouse Electric Corp; W. L. Lawrence, Radio Corporation of America; and T. J. Bailey, Wisconsin Electric Power Co

War Is Fed by Harvest of Civilian Economy, Wisconsin Group Told

War is fed by the harvest of the civilian economy, A. G. Bur, Wisconsin Public Service Corp, told the Sales and Service Section of the Wisconsin Utilities Association Convention, held at Milwaukee, Nov 8-10. This statement was issued as a warning to utility companies not to put their sales organizations in moth balls.

Donald D. Hoover, Bozell & Jacobs, told the general session that the American government has a huge machine grinding out propaganda, vicious propaganda because the people don't know about it. Hoover said that his organization is in the fight to preserve the utility industry. It does not want to indulge in propaganda but does want to tell the facts to the people who do the voting in this country, he explained.

The technical group heard E. W. Hatz, Wisconsin Electric Power Co, describe tests designed to indicate conductor movement to be expected from short circuit surges. Conclusions were that troubles from conductor movement could be eliminated by increased spacing, reduced short circuit currents, or shorter spans. His company chose to shorten spans at locations where appreciable trouble was being experienced.

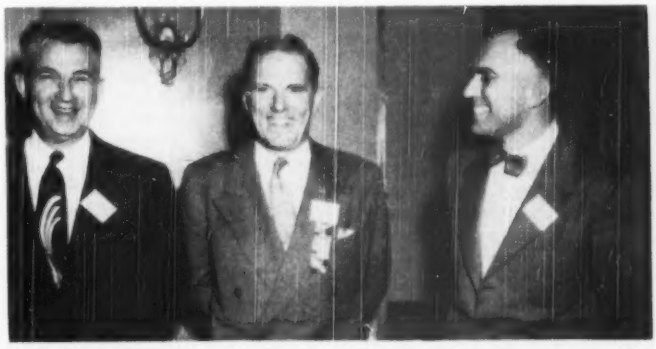
Ever increasing size of already heavy power apparatus was discussed by C. A. Scarlott, Westinghouse Electric Corp. He said that several 150,000-kw single-shaft generating units are now being built, that 220-kv circuit breakers of 10 2/3-million-kva interrupting rating have been tested, that talk now is of 15-million-kva breakers, and that 10-million-kva breakers are being built for lower voltages.

Higher efficiency and less fly ash are among the accomplishments of the cyclone furnace, reported W. T. McCullough, Babcock & Wilcox Co. He stated that cyclone furnaces are now supplying units having capacities totaling 485,000 kw. Sales, including those in service, total 24 units requiring 72 cyclones having a total capacity of 14,165,000 lbs of steam per hr and serving generating capacity of 1,375,000 kw.

Estimated revenues of power companies from television may reach as high as $110 million per year by the end of 1951, W. L. Lawrence, Radio Corp of America, said. A conservative estimate of present revenue is $31.5 million per year.

Corona from power lines is one source of TV interference, T. J. Bailey, Wisconsin Electric Power, said in discussing this problem. Such interference is accentuated in marginal broadcast areas where signals are weak, and it can be relieved somewhat by improved antennae.

Non-radio and TV interference appliances were one objective announced by Harold Williams, Wisconsin Power & Light Co, on behalf of the Appliance and Equipment Service Committee. The committee has recommended to Edison Electric Institute that an agency be set up to test and approve appliances on the basis of non-interference. The committee's



NEWLY ELECTED leaders of Wisconsin Utilities Association are, left to right, N. J. Fischer, vice chairman, and C. J. Forsberg, chairman, Technical Division of Electric Section; and W. H. Wagner, chairman of the Sales and Service Division

plan is to cooperate with manufacturers and report on appliances causing interference.

Connected load at the Research Farm owned by the association and operated by the University of Wisconsin, is 94.34 kw, Prof F. W. Duffee reported. Energy used in 1948 was 2,573 kwhr while use has grown to 3,781 kwhr for the first 10 months of 1950. Planning, development, and equipment installation are nearing the point where most valuable studies can be made and data obtained.

Reporting for the Meter Committee, C. P. Stahl, Wisconsin Power & Light Co, said that the test period on small meters has been increased to 96 months and that most companies are using the area testing method.

Leaders elected for the Sales and Service and Technical Divisions were Carl J. Forsberg, chairman, and N. J. Fischer, vice chairman, Technical Division, Electric Section. Forsberg is vice president, Wisconsin Power & Light Co, and Fischer is superintendent of transmission and distribution, Mississippi Valley Public Service Co.

William H. Wagner was elected chairman of the Sales Division, Electric Section, and Ross Williams was elected vice chairman. Wagner is sales manager of the Wisconsin Electric Power Co, and Williams is manager, commercial department, Wisconsin Michigan Power Co.

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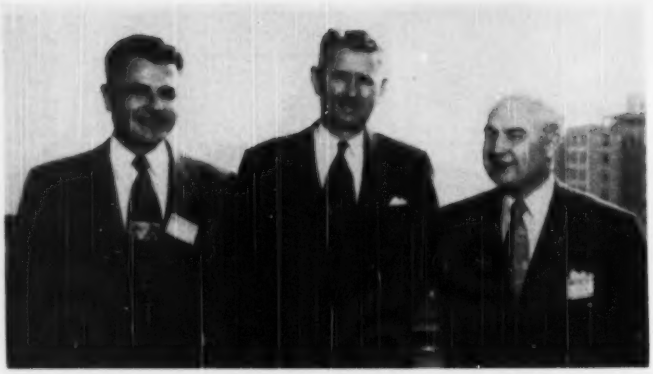
S. Dakota Utility Signs Contract with Reclamation

Northwestern Public Service Co, operating in eastern South Dakota, has signed a contract with the Bureau of Reclamation for "wheeling" and purchasing federal power.

Terms of the contract were approved last spring (EW, April 3, p 5), but the agreement was not signed by Secretary of Interior Oscar L. Chapman and company officials until Nov 10.

Similar to an earlier contract with Otter Tail Power Co (EW, March 20, p 11), the Northwestern agreement provides for sale by Reclamation to the company of up to 15,000 kw, as available, in addition to a 1-mill-per-kwhr fee for service to preference customers. Northwestern also may purchase up to 45,000 kw of secondary power from Reclamation's system in the Dakotas.



C. L. RICHEY, left, Sacramento Municipal Utility District; R. P. O'Brien, California Public Utilities Commission; and J. H. McCambridge, president, California Municipal Utilities Association; at the Association's annual conference

California Municipal Association Stresses Better Public Relations

Increasing preoccupation of municipal utilities with the problems and potentialities of a positive public relations program was evident at the annual conference of the California Municipal Utilities Association at Long Beach Nov 8-10.

One version of such a program was presented to the 140 in attendance by Carl L. Richey, Sacramento Municipal Utility District. He stressed that a satisfactory program requires not one major activity, but rather a wide variety of relatively small activities, courtesies, and services. Good employee relations, he added, are absolutely essential and, a primary requisite to good public relations.

Cost of money is the single overwhelming advantage favoring municipal ownership. This was the claim of Gilmore Tillman, Los Angeles Department of Water and Power. Cost of capital, represented by bond interest or dividends, is vastly more important in determining the price of the commodity sold by public utilities than in any other large industry. He compared capital costs on an $8 million utility at 6% under private ownership and 2% under municipal ownership. Such a utility would probably have gross annual revenues of some $2 million, and the difference of 4% or $320,000 annually in interest costs would represent a substantial potential rate cut.

Frequent changes of operators, engineers, and superintendents is a distinct disadvantage in municipal ownership, according to R. E. McDonnell, Kansas City consulting engineer. As an illustration he cited the state of Indiana, where when 65 municipalities changed political control, thoroughly trained and experienced men were displaced in nearly every municipal plant. He recommended formation of utility boards which would include three or five men with rotating terms of office. Such a board provides greater uniformity of policy and permits well-thought-out, long-range planning of utility improvement.

Federal hydro developments in California and government proposals to install large amounts of additional hydro capacity have restricted and postponed installation of a number of attractive hydro projects by California utility organizations. R. P. O'Brien, California Public Utilities Commission supervising engineer, named such federal intervention as an important factor influencing the trend toward construction of an increasing percentage of fuel oil-consuming generating capacity in California.

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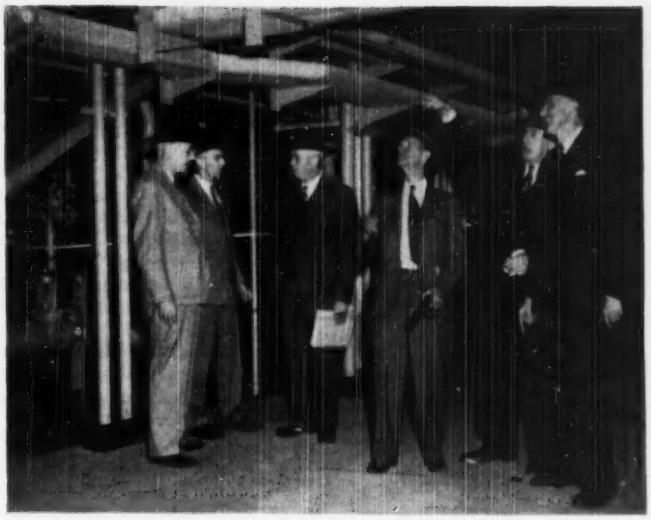
Sells Municipal System

Cooper, Texas has voted 424 to 295 to sell its municipal power plant and distribution system to Texas P&L Co.



OFFICIALS of West Penn Electric Co and West Penn Power inspect the latter's 44,000-kw steam-electric station dedicated at Milesburg, Pa. Left to right are H. S. Fitch, vice president, and P. H. Powers, president of Power; J. L. Rice, vice president and treasurer of Electric; J. E. Thomas, chief engineer of power plant; W. V. Drake, manager of power production; and E. S. Thompson, president of Electric

California Protesting Franchise Amendments

The State of California has protested proposed amendments of Pacific Gas & Electric Co franchises in Oakland in an attempt to force the utility to pay for relocation of its facilities made necessary by state freeway construction. C. H. Purcell, director of the state's Department of Public Works, wrote the city council that his department estimated that $2.5 million would be "saddled" on the state in the next 10 years if the proposed franchises were accepted.

PG&E and the city had reached an agreement by which the city was to receive $300,000 on accepting the new franchises, including $100,000 for a 50-year extension of its present electrical franchise and $115,000 for amendment of its gas franchise to eliminate ambiguity. The utility would also pay the city a percentage of gross gas revenues for the first time and increase electrical franchise payments.

PG&E had been operating its gas service under a perpetual franchise granted in 1865 for "illuminating" gas, and its right to furnish gas for other purposes has been questioned.

Under the Collier-Burns Highway Construction Act of 1947, the state must pay for relocation costs if the utility's facilities are lawfully maintained in a location which is not a state highway at time of installation, provided the utility's franchise doesn't specifically require that it pay such costs.

The state contends that PG&E's gas facilities have not been "lawfully maintained"—that it has no valid franchise for its gas for heat and power, and thus is liable for all gas relocation costs. It further asks that the city insert clauses in the proposed franchises requiring PG&E to pay such costs for both electrical and gas relocations in the future.

PG&E has borne to date about $83,000 for relocating gas mains and has billed the state for the full amount. A PG&E spokesman stated that unless an agreement is reached on the question, the company may sue for reimbursement.

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To Get Federal Power

Yuma, Colo., will receive all its power from the Bureau of Reclamation's Colorado-Big Thompson project, under terms of a new contract. Yuma has a municipal plant and formerly generated its own power.

13,500-Kw Unit on Line at Anderson Ranch Dam

The first 13,500-kw unit of the Bureau of Reclamation's new Anderson Ranch Dam in southern Idaho went on the line Nov 20.

The dam has an ultimate capacity of 40,500 kw. A second 13,500-kw unit will be placed in operation next year, but no date has been set for the third unit. Power from the dam will be used for pumping and service to cooperatives, and small amounts of peaking power and surplus energy will be sold to Idaho Power Co, bureau officials said.

Anderson Ranch Dam is the highest earth-fill dam in the world with a crest of 456 ft above bedrock. Construction, begun in August, 1941, was delayed by World War II. The dam is in Reclamation's Boise project which was authorized in 1905 and is one of the bureau's oldest projects.

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Reduced G&T Program OK'd for Alabama Co-op

The Rural Electrification Administration has approved a new, reduced generation and transmission program for the Alabama Electric Cooperative.

Under the new plan, the Alabama G&T will construct one 15,000-kw steam generating unit instead of the two 12,500-kw units originally planned. Transmission lines and substation facilities to serve three distribution co-ops in Florida and three in Alabama also have been deleted from the original plan, and the federation will supply only part instead of all power requirements of three other Alabama co-ops. Approval of the revised plan permits Alabama Electric to use $3,601,000 of previously loaned funds for the revised program.

The new steam plant, REA explained, will supplement diesel and hydro-electric power now generated by the federation and replace in part power purchased from Alabama Power Co.

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To Rebuild Diversion Dam

Ellensburg, Wash., will rebuild its diversion dam on the Yakima River to increase the flow of water in a canal supplying the municipal's hydro plant.

YIELDS (%) — Operating Electric Utility Securities

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1950									
Nov. 9	2.66	2.68	2.80	3.84	4.06	4.48	5.83	6.59	7.48
Nov. 2	2.67	2.70	2.80	3.83	4.05	4.46	5.84	6.68	7.36
END OF QTR									
3rd 1950	2.66	2.67	2.76	3.81	4.08	4.46	5.70	6.54	7.25
2nd 1950	2.68	2.66	2.74	3.79	4.03	4.38	5.38	6.51	7.50
1st 1950	2.59	2.61	2.74	3.78	4.01	4.36	5.25	5.85	6.67
4th 1949	2.59	2.61	2.79	3.85	4.06	4.46	5.37	6.15	7.01

Data: Reis & Chandler, Inc.

Seattle Voters Apparently Reject City Plan to Purchase Puget Power

Seattle voters apparently have rejected the purchase of Puget Sound Power & Light Co properties by the city—despite an almost complete lack of organized opposition to the proposal.

With all but about 6,000 absentee ballots counted, the "No" votes outnumbered the "Yes" by nearly 1,000 out of some 125,000 votes cast. The absentee ballots may change this result, but the odds are against it.

The result was a surprise to city and company officials who had joined forces in a well-organized campaign to explain the proposition to the voters. The only announced opposition came from employees of the two utilities, afraid of the possible effect on their jobs.

Mayor William F. Devin and Puget Power Pres Frank McLaughlin attributed the defeat to misunderstanding of the proposition's implications and to the large number of bond issues on the ballot. Up for consideration were five other bond issues, three of which were defeated. The power purchase proposal was at the end of the line, indicating that most voters had scanned every other issue before coming to it.

Contributing factors may have been fear of a monopoly and doubts aroused by the unions' advertising and the company's willingness to sell. Seattle voters have been subjected to a campaign against private power for so many years that many of them may have figured the proposition must be bad if Puget Power favored it.

Neither Puget Power nor city officials would commit themselves about the consequences of defeat before final tallying of the vote. Several courses are open, however.

In case of emergency the city council could approve the purchase without further action by the voters. This would become more likely if the margin between the "No" and "Yes" votes were narrowed or if the public utility districts made some move to enter the picture.

The same purchase proposal or a substitute could be offered again in the fall of 1952, although this would be after expiration of Puget Power's franchise in March, 1952.

City Light could move in to take over company customers in all areas it can serve and permit the company to operate beyond its franchise expiration date in sections where City Light service is not immediately feasible, such as in the 10-acre metropolitan tract in the heart of the business district. The company now has a monopoly in the metropolitan tract, and the city probably could not make the necessary installations by March, 1952.

PUD's which have been planning to buy the company system outside the Seattle competitive area might expand their purchase plan to include Seattle, but first they must get court approval of their right to act jointly in such a purchase.

Devin said he was "extremely disappointed over the apparent lack of understanding" by the voters of the proposed $25,850,000 purchase. McLaughlin said he was "sure the people did not vote for the chaos that will result" if the measure fails to pass, adding that this company "just has no way to stay in business."

The voting had an immediate effect on Puget Power stock which declined $1.50 in value from 17⅝.

Two Pierce County cities, Buckley and Sumner, voted against bond issues to acquire Puget Power properties in their areas. In another election involving the power issue, Asotin County voted against formation of a PUD.

FINANCIAL BRIEFS

Columbus, Ohio, voters in the Nov 7 election approved a new electric rate ordinance (EW, Sept 25, p 85) that will save consumers an estimated $3,225,000 over two years. Lowest in the city's history, the rate brought an end to protracted litigation between the city and Columbus & Southern Ohio Electric Co.

Central Power & Light Co, Corpus Christi, Texas, plans to buy the electric generating plant and distribution system owned by Jarbee Co in and near Freer, Texas, for $460,000 in cash. The utility will not buy the plant building but will have the right to operate the plant at its present location for five years. The properties to be acquired are in Central's service area and will be integrated into its system.

Voters of Rantoul, Ill., at the Nov 7 election approved a $400,000 bond issue for extension of the municipal electric system.

Electric Utility Financing—October 28-November 11

Company	Description	Amount of Offering (000)	Offering Price	Yield at Price to Public
Bonds				
Niagara Mohawk Power	2⅞% ref and new money	$40,000	101.259	2.81%

SCHEDULED

Bonds—Atlantic City Electric, 2⅞%, 1980, refunding, $18.4 million; Louisiana Power & Light, 1980, new money, $10 million.

Preferred Stock—Gulf Power, 51,026 sh, $100 par, new money and refunding, $5,103,000.

New September Record Below Output in August

September output was the highest for any September on record but 3.8% below the record 28,869,266,000 kwhr produced in August.

During September electric utilities produced 27,774,036,000 kwhr, the Federal Power Commision reports. This was 16.2% over September of last year.

For the year ended Sept 30 production reached 315,197,067,000 kwhr, 8.5% more than during the year ended Sept 30, 1949. This was the highest total of any 12-month period to date, 1.2% above the previous maximum set during the period ended Aug 31.

Water power plants produced 7,543,499,000 kwhr, which was 8.1% more than in September, 1949, and fuel plants turned out 20,230,587,000 kwhr. As a percentage of total September production water power output decreased from 29.2% last year to 22.2% this year.

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Hamilton Is Appointed Consultant to Chapman

George W. Hamilton, consulting electrical engineer, has been appointed a consultant on power supply to Secretary of Interior Oscar L. Chapman, who is Defense Power Administrator.

Hamilton, who will serve in the Defense Power Administration, also has served as a consultant to Chapman in the Roanoke Rapids case before the Federal Power Commission. He testified at some length against the proposed plans of Virginia Electric & Power Co for the site which Interior has sought to reserve for federal development.

During his long career, Hamilton has served as an official and consultant to many private power companies and public power bodies.

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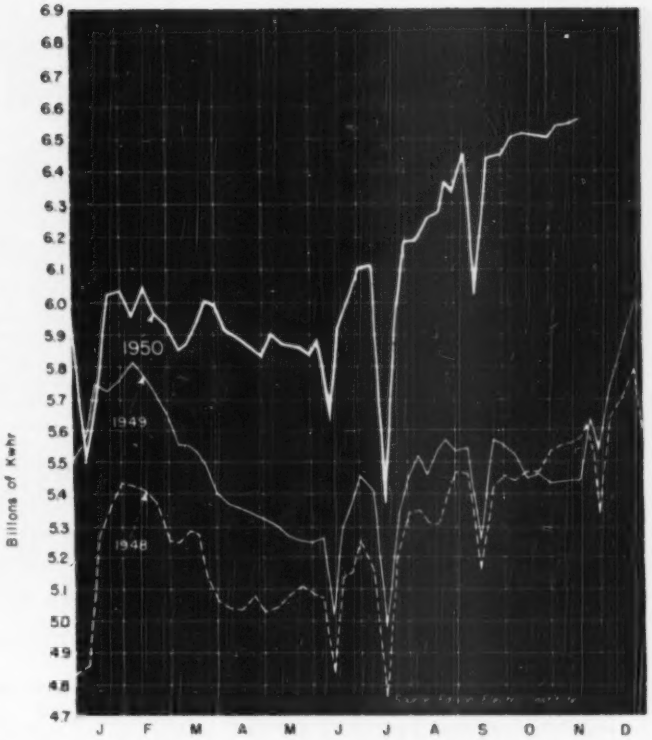
Generating Unit Ordered

Consumers Power Co of Michigan has placed an order for an additional generating unit. It will have an approximate capacity of 85,000 kw and will be larger than any now in operation in Consumers' system. Delivery is expected sometime in 1953, but, as yet, a definite site has not been determined.



Output Week Ended Nov 11—6,574,084,000 Kwhr

Weekly Output, Millions Kwhr						Percent Change from Previous Year			
1950		1949		1948			Nov 11	Nov 4	Oct 28
Nov 11	6,574	Nov 12	5,435	Nov 13	5,571	New England	+14.4	+12.8	+13.4
Nov 4	6,551	Nov 5	5,435	Nov 6	5,564	Mid-Atlantic	+15.1	+ 4.2	+16.9
Oct 28	6,563	Oct 29	5,433	Oct 30	5,555	Central Industrial	+30.7	+27.9	+29.7
Oct 21	6,503	Oct 22	5,430	Oct 23	5,539	West Central	+18.7	+15.3	+15.8
Oct 14	6,509	Oct 15	5,481	Oct 16	5,482	Southeast	+24.0	+22.1	+22.9
Oct 7	6,514	Oct 8	5,450	Oct 9	5,482	South Central	+22.1	+29.4	+23.0
Sept 30	6,503	Oct 1	5,521	Oct 2	5,449	Rocky Mountain	+13.4	+17.9	+15.7
Sept 23	6,457	Sept 24	5,556	Sept 25	5,461	Pacific Coast	+14.6	+17.2	+14.6
Sept 16	6,449	Sept 17	5,579	Sept 18	5,426				
Sept 9	6,029	Sept 10	5,258	Sept 11	5,166	Total United States	+21.0	+20.5	+20.8

FPC Issues 4 State Maps of Electric Facilities

The Federal Power Commission has just issued four new maps in its state series, but it will take a little explaining to get them.

The maps show principal electric facilities in Oregon, South Dakota, north Texas and south Texas.

Along with other FPC maps showing the location of electric facilities, the new maps have been classified "restricted." Orders made out to FPC's publication section should show the name and organization of the person ordering, reason for ordering, and the use to be made of the material. Price of the maps is $1 each.

MEETINGS

American Society of Mechanical Engineers
Annual Meeting, Hotel Statler, New York, November 26-December 1; National Power Exposition, Grand Central Palace, New York, November 27-December 2.

Edison Electric Institute
Prime Movers Committee, Hotel New Yorker, New York, November 27-28.

American Standards Association
Annual Meeting, Waldorf-Astoria Hotel, New York, November 27-29.

Interstate Power Club of New York
Hotel Martinique, New York, December 11.

★**American Institute of Electrical Engineers**
High Frequency Measurements Conference, sponsored with the Institute of Radio Engineers and the National Bureau of Standards, Statler Hotel, Washington, D. C., January 10-12; Winter General Meeting, Statler Hotel, New York, January 22-26.

★ Addition this week.

WASHINGTON COMMENT

RONALD D. ROSS

Defense power loads haven't been spelled out in anything so definite as kilowatts and kilowatt hours yet, but already some of the answers to the new power problems are taking shape. Washington planners have a pretty good idea of where the new loads will fall and how they will be met.

Plans for expanding aluminum production are being pushed ahead, and magnesium production and new Atomic Energy Commission loads are likely to follow similar patterns. These are the "big three" in defense power requirements.

Official talk of upping annual aluminum production by a billion pounds—a 70% hike over the present rate of 1.4 billion lb—has made one fact clear from the start: There isn't enough low-cost hydroelectric power available or even under construction to carry all the new loads. Major new hydro developments would take prohibitively long times to construct. Hence, with two exceptions, water power is out of the new defense load picture. The exceptions: A reactivated aluminum potline and a reactivated magnesium plant, both on the Columbia at Spokane, and both to operate with interruptible power, and aluminum potlines being planned near Hungry Horse Dam which will be producing power in Montana within two years. But these presently planned developments are about the limit of federal hydro's capacity for meeting major new defense demands.

Two other types of relatively low-cost power are available, and they will bear the brunt of the demands for aluminum and probably magnesium and atoms as well.

First, there's American Gas & Electric Co's new Philip Sporn plant (EW, June 5) at New Haven, W. Va. This historic new plant, built on coal fields, promises to bring coal-fueled steam power into the "cheap" classification. Kaiser Aluminum & Metal Co is planning four potlines to be operated with power from the Sporn Plant. Washington observers believe this pioneering low-cost steam power venture can be simulated in other coal areas.

The other promising type of low-cost power production for aluminum is gas-fueled plants, built on or near the natural gas fields in the South and Southwest. Aluminum Co of America's Point Comfort, Texas, Plant and the Jones Mill Plant of Reynolds Metals in Arkansas are successfully operating examples.

Gas fields and coal mines aren't the only factors in locating new plants for defense. The Northwest and California are considered potential coastal targets in event of a new war. Likewise, the East Coast is rated a target possibility, and even the nation's northern tier of states are in the line of raids across the Arctic. Fortunately, the more important coal mines and gas fields are not in these areas.

For defense power expansion, the nod is going to the deep South (below TVA), the Southwest, and the Ohio River valley. In addition to the West Virginia coal region, southern Illinois' coal deposits could be tapped for fueling new steam plants. And there are important coal fields in Alabama. Even more important in billion-pound aluminum programs and other defense projects may be the great gas fields of the Gulf coastal area.

A disproportionately large share of aluminum and magnesium expansion and perhaps the H-bomb plant all will be located within an area including Texas, Louisiana, Arkansas, and portions of Oklahoma and Missouri.

Fuel and geography already are answering the question of where the new defense power load will fall. But there are other major problems such as who is to finance, build, and operate the power plants. Some of these answers will come fairly soon. Meanwhile, there's growing optimism in the capital that the tremendous new defense loads can be met without serious disruption to present power users—despite the absence of any reservoir of new, unclaimed federal hydros such as was tapped in World War II.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Corona on high-voltage dc conductors is accentuated by water drops that become more and more pointed under vibration; such a condition results from interaction of the electrostatic and surface tension forces.

Gas under pressure is performing reliably in cables and it could be used as the fluid dielectric in transformers; why not make it one system without troublesome stop-joints?

Double buses with two selector switches backing up a third breaker for fault clearance are now deemed much less necessary; in fact, the same can almost be said of two in a row on a single circuit.

Gas turbines can function theoretically with steam as the working fluid, the exhaust being condensed by compression without the sacrifice of heat to river, lake or sea entailed in the conventional steam cycle.

Hydrogen in synthesis to heavier atoms is worth ten times as much, energy-wise, as uranium; one pound transformed into helium releases about 100,000,000 kwhr of heat energy.

Cables of 400 kv or even higher could be made by any of the major cable companies if they had the order, but there is much less assurance that equally good terminals and stop joints would be forthcoming.

Standards are commendable, but it is well to derive the nutrient of existing ones in preference to initiation of additional standards that may prove indigestible.

Aluminum can be soldered without flux and with standard soft solders (preferably SnZn) by use of an electric iron supplemented by a magnet-ostriction transducer that generates ultrasonics to destroy the natural aluminum oxide as fast as it tends to form.

HIDDEN BY SHRUBS, semi-buried enclosure for transformers is hardly visible from the street in residential area

Modern Buried Cable Distribution For New Residential Developments

When installed in new developments, buried cable systems approach the cost of conventional overhead distribution. Author examined types of buried cable systems in use today; evaluated their relative effectiveness—suggests improvement

JOHN S. PARSONS, Distribution Engineer
Westinghouse Electric Corp, Pittsburgh, Pa.

Today more than 400 American cities and towns are supplied in part by underground distribution systems. The future should bring a considerable increase in this use of underground distribution systems because of the advantages they offer. Besides improved appearance due to the removal from sight of overhead equipment, the public is less likely to come in contact with underground equipment, resulting in greater safety. Generally better segregation of the circuits and equipment underground than overhead also makes for safer working conditions for power company personnel. Moreover, an underground system will be free from service interruptions due to the elements and to mechanical damage from foreign objects coming in contact with the circuits. Finally, an underground system will usually have a longer life than the poles and cross arms of the overhead system. Summarized briefly then, the advantages of an underground system are: (1) Improved appearance, (2) fewer service interruptions, (3) lower operating and maintenance costs, (4) greater safety, and (5) longer life.

This is the last article written by Mr. Parsons before his untimely death August 22.

There Are Disadvantages Too . . . Obviously the underground system also has its disadvantages, otherwise all distribution systems would be underground. Most serious is its greater installed cost. There are so many influencing factors that there is no fixed ratio between the cost of underground and overhead systems. The usual form of underground system in this country using ducts which permit circuits to be installed or removed

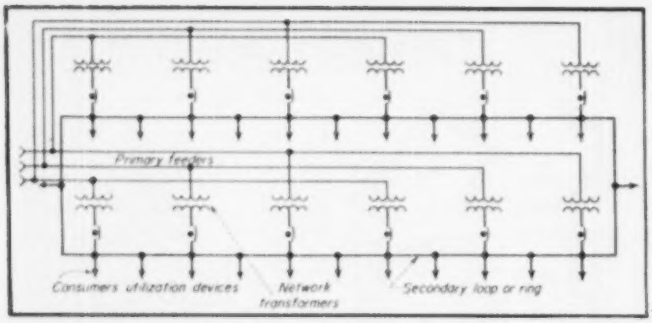


FIG 1—SECONDARY NETWORK system where circuits are buried cables. Three-phase transformers and protectors are in underground hand holes

without digging will cost from two to six times as much as the corresponding overhead system. The other form of underground system is the buried system in which circuits are placed directly in the ground. The installed cost of this system approaches more nearly that of the overhead system.

Another disadvantage common to both conventional and buried cable types of underground systems is the much longer time required to locate and repair circuit faults. Almost all faults on underground systems are of a permanent nature, whereas 80 to 85% of the faults on an overhead open-wire system are of a temporary nature. There are considerably fewer faults on an underground system, however, because the circuits are less exposed. The difference in the nature of the faults and in the time required to locate and repair them influences system practices and patterns used in underground systems as compared with overhead open-wire systems. For example; automatic reclosing is rarely used on underground cable circuits because of the permanent nature of the faults.

Underground Systems for Residential Areas . . . While the application of underground distribution systems can be justified most readily in the heavy-load density commercial areas of cities and towns, use of underground systems in the better residential areas of cities is being given serious consideration today. The return per consumer or per block in these areas is much less than in the commercial areas. Therefore, the investment in distribution system per consumer or per block must be kept below the cost of the usual form of underground system used in the commercial areas. Some type of underground system with cables buried directly in the ground appears to offer the best possibilities for a satisfactory lower cost system.

The development of lower cost buried underground systems is still in the formative stage. It should be emphasized that these buried underground distribution systems are at present being used in and considered for new real estate developments where common trenches with some of the other utilities can be used. When installed under these conditions, the initial cost of an underground system will often be reasonably close to that of an overhead system. Some estimates indicate that such an underground system can be installed for about $50 to $75 per consumer more than an overhead system. Costs of this order should make an underground system attractive. It should often be possible to get the real estate company developing the new area to pay all or part of the differential in cost.

There is no general thought that these residential underground systems will be used to replace existing overhead systems. The cost of putting an existing overhead system underground is very much higher than installing an underground system originally in a new development. The demand for underground distribution in residential areas may increase, and if the consumers show a willingness to pay the cost of changeover, such a trend may be accelerated. Operating experience obtained with new or existing underground systems will be very valuable in deciding what to do in the areas where changeover from overhead systems is contemplated.

Buried Secondary Network . . . There are a number of types of underground distribution systems which deserve consideration for use in the better class residential areas. Where the highest quality of service with the greatest ease of operation and maintenance is desired, an ac secondary network type of system should be used. This will usually be a three-phase system with three-phase transformers and three-phase four-wire secondaries. The primary and secondary circuits would be buried cables. The network transformers and protectors may be located underground in small vaults or above ground on concrete mats. If this equipment is placed above ground or partially above ground, it may be enclosed in kiosks or surrounded by fences and shrubbery. Two or three primary feeders may be used to supply the network transformers. Three feeders will usually prove to be the most economical because of the resultant saving in spare transformer capacity. The secondary circuits should preferably be protected by limiters. Services may be tapped from the secondary mains in small underground service boxes or above-ground service pedestals. The buried cables may have limiters installed in them where they connect to the secondary mains. The secondary mains should form either a grid or a loop. The loop secondary will usually prove to be the more economical and simpler to use in residential areas. One or more separate loops may be supplied from one group of primary feeders.

Fig 1 shows the single-line diagram of a buried form of underground ac secondary network system similar to what has been used in a few residential districts. In these systems the cables are buried, the three-phase transformers and protectors are in underground vaults, and the service connections are made in underground handholes.

The buried form of ac secondary network system is very desirable for residential areas. However, because of cost its application will usually be limited to those areas where the load density is relatively high, such as semi-commercial and apartment districts, or where service continuity is of more than usual importance.

Radial System Most Common . . . The type of underground system that appears to have the greatest field of application in residential areas is a radial system. The general pattern of this system is similar to the overhead systems commonly used in such areas. The single-phase primary circuits and the single-phase three-wire secondaries will be buried cables. The primaries may be radials or loops fed from either an underground or an overhead feeder. Where the new residential area is relatively small, the underground primary will usually be fed from an existing overhead primary feeder. The buried secondaries may be radial circuits, each fed by a distribution transformer or they may be connected together to form line-type or loop-type banks. The consumers' services may be tapped from the secondaries either in simple underground handholes or above-ground boxes or pedestals. Such a buried system may be installed along the streets or along the back lot lines. When installed along the streets, the system is more accessible. Also, supplying multiple street lighting from it is simplified.

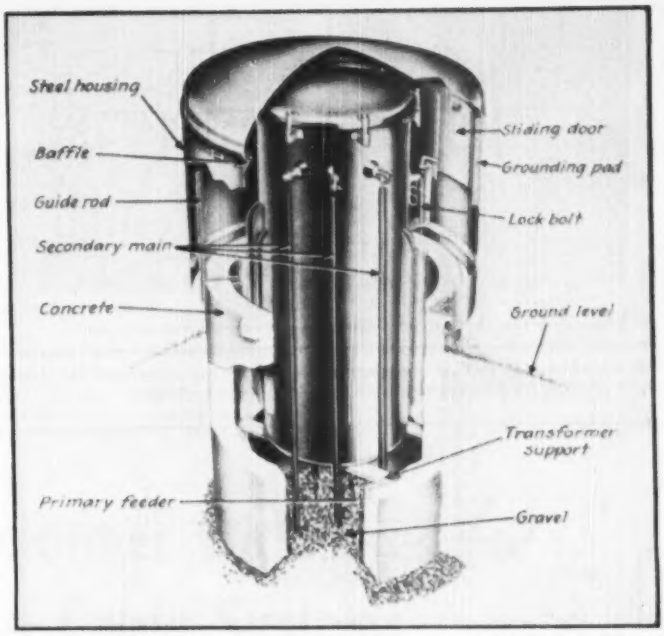


FIG 2—SEMI-BURIED ENCLOSURE for transformers in a buried cable residential distribution system. Steel section can be removed

Semi-Buried Transformer Enclosure . . . In most residential areas the expense of subway-type distribution transformers, fuses, etc, located underground is not justified. A system where the same types of single-phase distribution transformers as used on overhead systems are located partly above and partly below ground in an enclosure is shown in Fig 2. The lower part of the enclosure is mostly below ground and is made of concrete to prevent corrosion. Normally locked to this concrete section is the upper part of the enclosure which is made of steel. The steel section is arranged so that it can be removed easily to permit access to the transformer. The enclosure is provided with ventilating openings to permit adequate cooling.

Primary and secondary cables are brought to the transformer through the open bottom of the enclosure. The connectors commonly used at the transformer terminals are arranged to permit manual sectionalizing of the buried cables at these points. Such sectionalizing is necessary to permit restoration of service when a cable fails, without waiting until the defective cable is dug up and repaired. When a primary cable fault occurs, it is necessary to locate the defective section and disconnect it from the system at the two adjacent sectionalizing points. If the primary circuit is a loop, service can be restored by re-energizing the primary

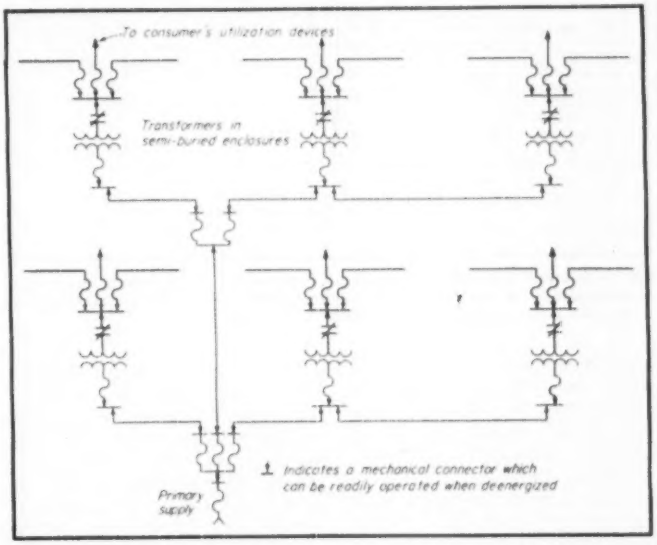

To consumer's utilization devices
Transformers in semi-buried enclosures
1 Indicates a mechanical connector which can be readily operated when deenergized
Primary supply

FIG 3—RADIAL BURIED CABLE SYSTEM for distributing power in residential areas. Transformers are in semi-buried enclosures, branch fuses in similar houses are of type used on overhead systems. Within tank are protective links in the H.V. leads

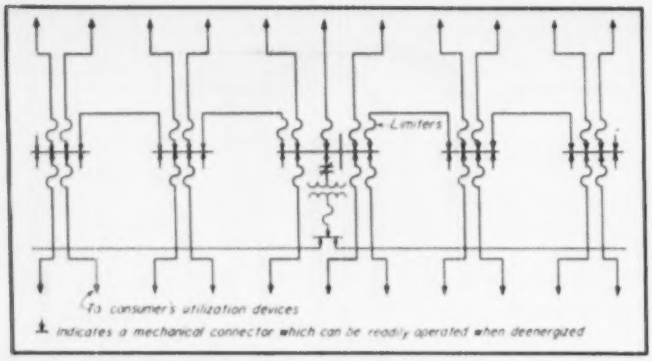

Limiters
To consumer's utilization devices
indicates a mechanical connector which can be readily operated when deenergized

FIG 4—ARRANGEMENT of secondary cables and service cables supplied from transformers of Fig 3 and connected to the busses through limiters

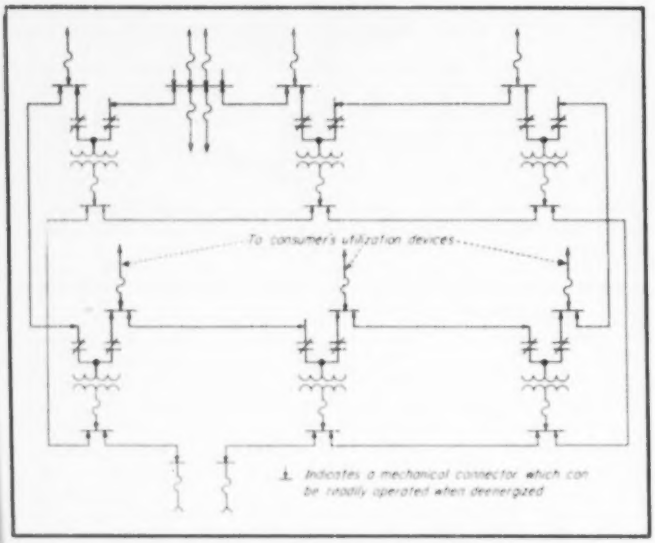


FIG 5—BANKED SECONDARY buried cable system for distributing power in residential areas. It is not necessary to use temporary cable to restore service when cable fault occurs, except in the case of a service cable

after the defective section is disconnected. When a radial primary circuit is faulted, it is necessary to replace the disconnected defective section with a temporary cable laid along the ground. The ends of the cable are taken into the enclosures of the two adjacent transformers through the ventilating openings and connected to the transformer terminals at the points where the faulted cable was disconnected. Service is restored over this temporary cable until the buried cable can be repaired.

The transformers in such a system can of course be placed entirely above ground. The advantages of semi-buried transformers, that is, transformers located partly below ground, are improved appearance and greater ease of getting at the transformers and making cable connections. The enclosure in Fig 2 is large enough to take any single-phase transformer up to and including a 50 kva. The enclosure is also used for improved safety and appearance. It prevents unauthorized persons from coming in contact with the transformer and cables and thus protects both the public and the equipment. The inconspicuous appearance of these semi-buried transformer installations with both sections of the enclosure in place is shown in the accompanying picture.

The single-line diagram of such a buried-cable radial system is shown in Fig 3. The system uses pole-type single-phase distribution transformers in semi-buried enclosures. The transformers have inside the tank protective links in the high-voltage leads and thermal circuit breakers in the low-voltage leads. The thermal breaker trips in response to current through its transformer and temperature of the transformer oil.

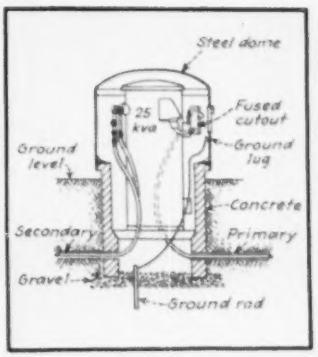
Primary Fuse Enclosures . . . The buried radial primary branches and laterals are fused to reduce the extent of an outage and to facilitate locating a fault. These fuses are located in enclosures similar to those used for the transformers and may be the same as used on overhead systems. A greater use of fuses is justified in a buried-cable system than in an overhead open-wire system. The fuse and transformer enclosures also provide convenient sectionalizing points.

The way in which secondary and service cables are arranged is shown in Fig 4 on this page. Both secondary cables and service cables are connected to the busses through limiters. Service boxes are usually placed at intervals of about 100 to 150 ft along the street.

The service boxes may be located either above or below ground. The below-ground boxes are preferable from an appearance standpoint and are less likely to be tampered with or accidentally damaged. The buses and connections can easily be made suitable for service below ground at little or no more cost than would be required for above-ground service. In addition to serving as take-off points for the consumers' services the service boxes provide convenient sectionalizing points for faulty cable. A faulty secondary cable or service cable is replaced by a temporary cable laid along the ground until repairs are made.

By using a loop-type banked secondary system whose transformers are supplied from a primary loop, as shown in Fig 5, it is not necessary to use a temporary cable to restore service when a cable fault occurs, except in the case of a service cable.

SAVINGS OF 25% over older design is effected by this semi-buried distribution transformer vault used by Puget Sound Power and Light in residential areas



VAULT SECTION shows how precast vault and steel dome enclose 25-kva transformer. Vault is similar to one used for earlier installation with fiber duct

DRAINAGE PROBLEM of earlier design is eliminated by above-ground-level location of connections. Cylindrical metal cover slips over the angle iron supports

New Transformer Enclosures For Buried Cable Systems

Eliminate drainage problem of older pre-cast concrete vaults serving restricted residential areas from underground

J. J. STEIN, Associate Engineer
Puget Sound Power and Light Co, Seattle, Wash.

Underground distribution with standard transformers in partially above ground enclosures has proved to be the most economical way for Puget Sound Power and Light to serve restricted residential areas without overhead construction. Customers are well-pleased with the appearance of new lightweight cylindrical metal dome enclosures, even before shrubbery and other plantings are put in. Of course, shrubbery is a very worthwhile final touch.

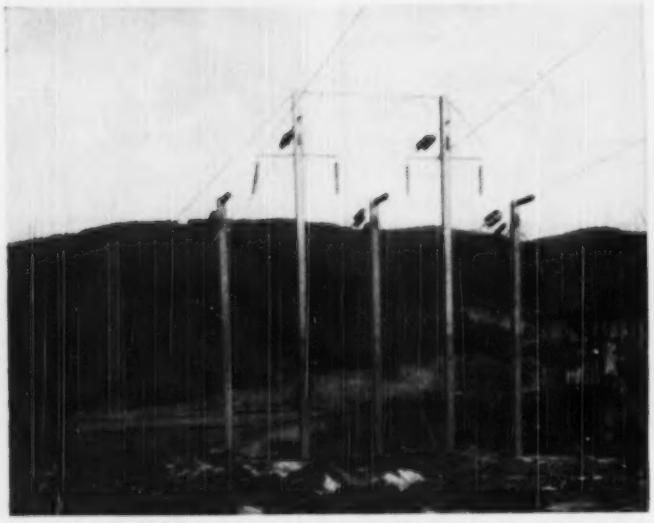
Washington state law requires that where men enter a vault to work on energized equipment the vault must be at least 6x6x6 ft, which has precluded consideration of conventional underground in residential areas. Several years ago the company developed a pre-cast cylindrical transformer vault (**Electrical World,** Oct. 23, 1948) which has been used extensively despite some difficulty in securing proper drainage in certain areas. Submersible cable termination and transformer fusing required added materially to the over-all cost of the completely underground installation.

Specifications have been revised to incorporate the new pre-cast semi-buried concrete vault and light weight cylindrical cover, eliminating the need for submersible cable terminals and cutouts, and for providing drainage. This has effected an estimated saving of 25% in installation cost, compared with the completely underground pre-cast transformer vault installations.

One installation of this equipment has been completed in a residential tract just outside of Seattle, Wash. The tract is on a hillside with cul-de-sac roadways and has a 10-ft utility easement across the backs of lots which is not subject to traffic. The system consists of 25 pre-cast enclosures each containing a 25-kva transformer, and 6,500 ft of cable and conduit. Distribution is radial with the 2.4-kv single-phase primary cables tapped to a 2.4/4.16-kv primary overhead loop around the project. The vaults are approximately evenly divided over five individual cable runs. They are located so as to minimize the number of vaults and distribute equitably the length of service run required.

Primary Cables . . . All primary cables are 5-kv, No. 4, single conductor synthetic rubber-insulated, synthetic rubber-jacketed, the neutral is No. 4 weatherproof. Primary cables are in 2-in. steel conduit up the poles and under roadways, and in 2-in., Type II heavy fibre or cement-asbestos duct directly buried in the earth in the balance of the project.

Customers are individually responsible for the installation and maintenance of their own secondary conduit and cable from their respective residences to the transformer vaults, there being no secondary cable nor conduit in the company's facilities.



DEADEND STRUCTURE for 3,370-ft span across proposed reservoir is made from 87 lb/ft, 14-in., WF H-section steel columns. Structure is braced by three sets of intermost guys and 33 down guys as in wood pole guying. Pole top (lower left) carries circuit down to 1,500-kva substation at tunnel intake

PLYWOOD PROTRACTOR made in the field was used to set guy rods at proper angle. Concrete for guy anchors was poured before steel columns were erected

Steel Columns Support 3,370-ft Span

Construction of a 3,370-ft span between inaccessible mountains had to be finished in three months, even though winter was approaching. Here is how guyed, steel column deadend structures were used to meet the deadline

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New York State Electric & Gas Corp, Binghamton, N. Y.

To furnish power for the construction of the Delaware Aqueduct, a part of the water system expansion program of the City of New York, it was necessary for New York State Electric & Gas Corp to extend its 114-kv facilities about 23 miles through the heart of the Catskill Mountains. The immediate problem was to complete the first 15 miles of this 2-pole, H-frame line in three months, by January 1, 1950, to provide power for a substation at a tunnel intake on the East Branch of the Delaware River.

Crossing Was Problem . . . However, to reach this substation, it was necessary to cross a proposed reservoir from one mountain to another. Construction of this crossing was complicated by several major factors:

1. The proposed span measured over 3,300 ft horizontally; conventional, self-supporting, steel tower designs were found to be inadequate. Furthermore, there was not enough time to prepare an entirely new tower design or order materials required for a new design.

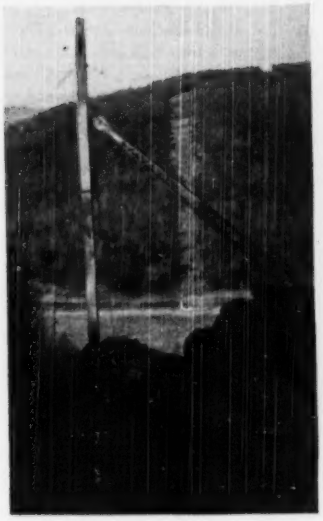
2. Winter usually sets in solidly by early November in the Catskills.

3. Inaccessibility of the two mountains meant that "roads" had to be built for the transportation of men, vehicles and heavy construction materials to the sites.

Nevertheless, in the face of these and other minor obstacles, here is how the crossing was made.

A profile survey indicated that the crossing could be made at only one site if the span and height of supporting structures were to be kept to a minimum and the required clearance above water of 100 ft at maximum sag was to be met. Structure locations selected at the most desirable spots, from a construction standpoint, resulted in a span of 3,370 ft.

Ground elevation at structure locations, combined with the sag limitations, dictated the use of special high strength conductor to avoid extremely high supports. The conductor selected was 345,200 cir mils ACSR, having 19 steel strands, 15 aluminum strands and an ultimate strength of 41,500 lb. Because of the inaccessibility of the crossing, particularly after the reservoir was filled, and the severe lightning exposure, this conductor was used for both the phase wires and overhead ground wires. Using maximum loaded



STEEL COLUMNS were spotted by power shovel with demountable 30-ft boom. Power shovel was dragged to site by tractor over ice-covered mountain roads

COLUMN BASES and footings, as well as concrete slugs for anchors, were poured from a 3-yd transit-mixed truck. To provide concrete for both deadend structures, this truck was dragged to the sites by tractors 22 times over "roads" having up to 40 deg grades and covered by ice, snow, water, mud, slush and frozen dirt

Across Delaware River Reservoir

tensions of 40 and 47% ultimate on phase wires and ground, respectively, it became apparent that steel rather than wood structures were required. Moreover, conventional self-supporting, steel tower designs were inadequate both from strength and conductor spacing standpoint.

Steel Columns Used . . . The nearness of the deadline prompted the use of steel columns, guyed in a manner similar to wood poles. A five column structure was designed using 14-in. wide flange columns weighing 87 lb/ft. Columns for ground wires are 67 ft high; phase wire columns 51 ft high. All columns are spliced at 29 ft from the base. This design made it possible to obtain all of the steel, including the anchors, in a few weeks, whereas a specially designed self-supporting structure would have required several months for delivery. Because the steel order was placed before an accurate cross sectional profile of the site could be made, all phase wire columns had to be ordered the same length and both static columns 16 ft longer. Thus it was necessary to dig, mostly in solid rock, holes from 6 to 11½ ft deep to level the bottoms of the columns.

Excavations for 5 column footings and 49 anchor holes at each site were started immediately and were dug where possible by a truck-mounted digger. The truck was hauled to the site by tractors and was kept from rolling down the right-of-way by winch lines.

Anchors consist of two 5-ft lengths of 8 in., 18.75 lb standard channels back to back and separated 4 in. by plates on bottom and top. Anchors are set a minimum of 4½ ft in solid rock and 9 ft in earth. They were made into a concrete slug 6x2x2 ft, undercutting the compression side of the hole, and providing a useful area of about 3,000 sq in. Anchor leads of approximately one to one were used in all cases.

Because anchors had to be installed and concrete set before erection of the columns, it was necessary to locate and support guy rods at the proper angle while the cement hardened. Therefore, structures were drawn to scale on paper and vertical angles of the guys measured with a protractor. A 3-ft plywood protractor, made in the field, and a plumb-bob helped to locate guy rod angles properly. To support and level the columns, concrete pads of varying thickness, but at least 1 ft thick, were laid.

Vital Statistics For Towers and Span

Static columns	67 ft
Phase columns	51 ft
Column	87 lb, 14 in., WF H-Section, spliced 29 ft from bottom plate
Conductor (phase and static)	345,900 cir mils ACSR-19 steel, 15 aluminum
Insulator Attachment	2 strings 25,000 lb, 10-10 in. discs
Length of span	3,370 ft
Distance low support from high support	88 ft vertical
Final sag below low support	171 ft (phase)
Initial sag below low support	160 ft (phase)
Final tension	
Phase	16,640 lb
Static	19,600 lb

Tractors Pull Vehicles . . . Probably one of the most unorthodox construction methods employed was the use of

a transit-mixed concrete truck to pour the anchors, footings and column bases. A contractor with a three-yard truck was found who would chance the mountain "roads." Tractors hauled the truck 1½ miles to the top of the two mountains 22 times, over ice and through water, snow, mud, slush and frozen dirt, up 30 and 40-deg slopes. To erect the steel, the owner of a power shovel with a demountable 30-ft boom was inveigled into trying the "roads," which by that time were well frozen.

Turnbuckles are used on all phase and static conductors as well as on each guy. Because it was thought advisable at first to have deadends compressed at the factory, turnbuckles 2 ft long were ordered for all conductors. However, only one deadend was factory-made for each conductor and the other made up in the field, so the 2-ft turnbuckle was longer than actually needed.

In all guys, tension was adjusted by means of a clamp-on dynamometer and 1-ft turnbuckles. These turnbuckles are 1¼ in. in diameter for the ⅝ in. EHS Copperweld head, back and transverse guys, and ¾-in.

DEADEND position on conductor was located with tape after line was initially sagged in. Come-along on temporary line held conductor over valley while deadend was attached on the south mountain

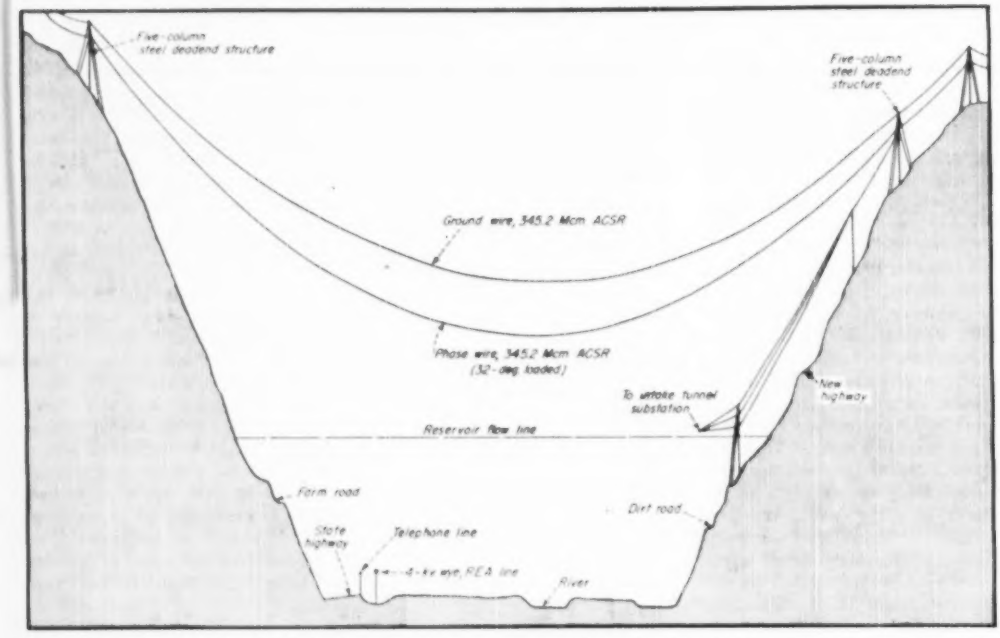
in diameter for the midpoint or anti-buckling guys, which are ⅜ in. EHS Copperweld.

Columns and anchor rods were fabricated with a 9/16 in. hole near the ground line for attaching a No. 2 solid copper ground wire. Ground wires are bonded together by two concentric, interconnected grids.

After factory-made deadends had been attached to the north tower, all five wires were run simultaneously to the foot of the south mountain. Then one wire at a time was winched to the top. Conductors were sagged, released part way, and compression deadends made up on the ledges of the south mountain. Conductors were again pulled into position by tractor and final adjustment was made with the turnbuckles.

Ground wires were insulated in the span and grounded at the structures, thus providing two spare conductors by re-arrangement of jumpers. Mid-span separation between conductors and ground wires was obtained by sagging the ground wires at a slightly higher tension. Because of the long span and poor visibility, two handie-talkies were used advantageously during stringing and sagging operations.

Deadline Was Met . . . Sagging of the conductor was completed on December 30. The balance of the line was completed the previous week, but because of a delay in securing some of the customer's equipment, it was unnecessary to provide 114-kv service immediately. The line was energized January 8, 1950.



CROSSING of the East Branch of the Delaware River near Pepacton, N. Y., was made in three months' time, although it was winter and the two tower sites were accessible only over mountainous "roads" which were usually covered with ice, snow or slush. Due to a shortage of time guyed, steel columns structures had to be used for the deadend towers

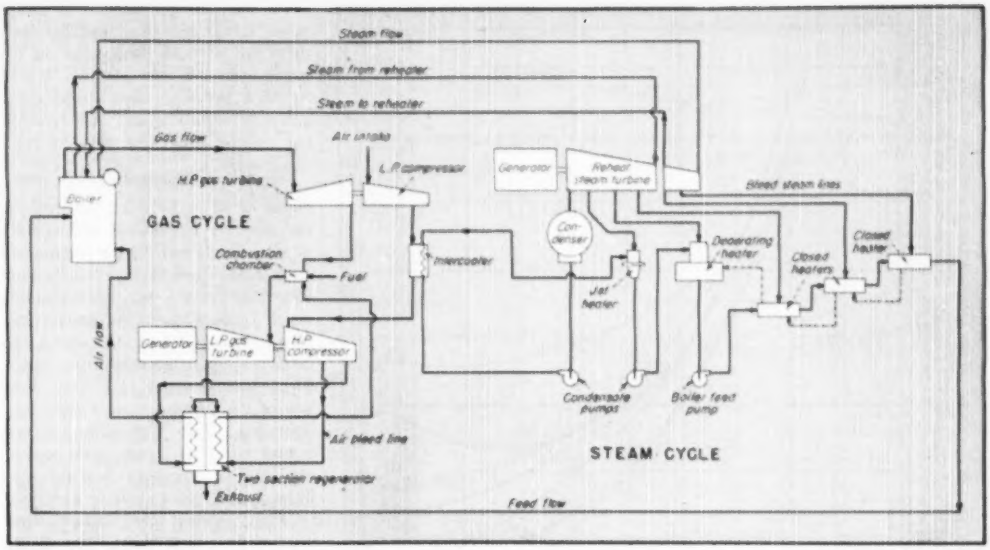


FIG 1—COMBINING GAS TURBINE and steam turbine cycles through a pressured-furnace boiler offers a potential betterment of 10-14% in thermal performance over steam cycle without gas turbines. As shown in Fig 2, one combination of the two cycles can deliver a net kilowatthour for 8,200 Btu—about 12% lower than any steam station now operating

Gas Turbine with Pressurized Boiler Gains 1,000 Btu vs Steam Alone

Heat balance study of combination cycles reveals possibility of Btu rates as low as 8,420 Btu per kwhr with steam 1,665 psi/1,000 F and gas turbine burners getting 100 psi air

RALPH C. ROE, President, and ROBERT F. CUMMINGS, Vice President
Burns and Roe, Inc, New York, N. Y.

In the development of both the gas turbine and the steam cycle the metallurgical problem has always been in the forefront. In 1827 Jacob Perkins was granted a patent for a compound engine designed to operate at 1,400 psi, but he could get neither boilers nor engines for this pressure and it was a century later before a central station was built for about this pressure and about 750 F steam temperature. It took nearly another quarter-century to develop and find general acceptance of metals that would permit reliable operation at 1,000 F.

Gas turbines are now being built for initial temperatures of 1,500 F and research is trying to develop metals for still higher temperatures. But such development is slow, though more rapid than in the past, and for some years our designs will be limited probably to a maximum of around 1,000 F to 1,200 F for steam and 1,200 F to 1,500 F for gas turbines.

Temperatures Set Limits . . . These temperatures set rather definite limits to hopes for further reduction in the fuel consumption of our central stations operating on the presently contemplated steam cycles. Gas turbines are coming on the market in the smaller sizes, and a few of the manufacturers are beginning to contemplate offering them in the minimum sizes applicable to central station service, but as yet they have not been offered in large sizes comparable to large-size steam turbines. It is clear that inlet temperatures must exceed 1,000 to 1,200 F for steam and 1,500 F for gas turbines which now seem the practical limit if much gain in efficiency is to be realized with our present commercial cycles. The question has been raised: "Can gas turbines in their present size be justified when fitted into the central station cycle?"

In a gas turbine, fuel must be burned and the gases cooled to metallurgical limits before the gas enters the turbine. The present practice is

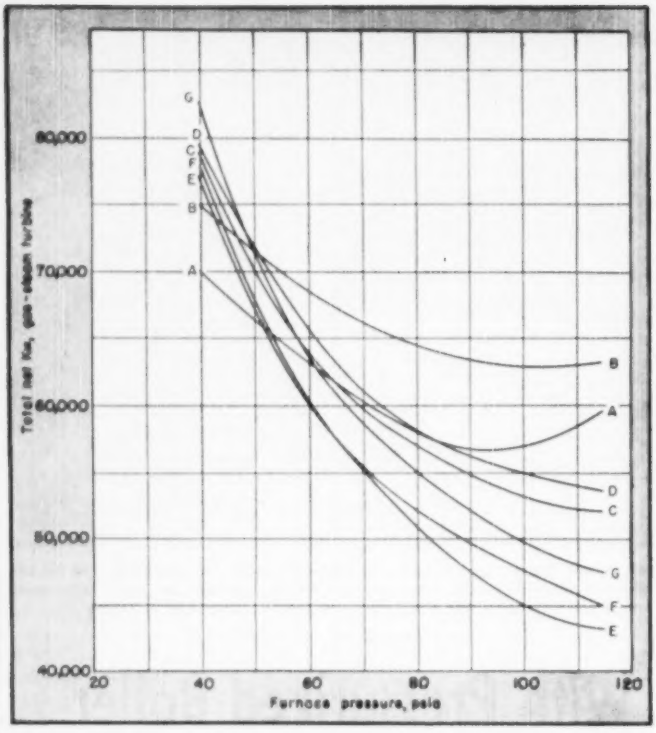


FIG 2—MOST PROMISING of seven cycle combinations shows that increase in furnace pressure generally causes a shrinkage in thermal performance, but a greater shrinkage in combined kw capacity of gas plus steam turbine. In these seven studies, combined capacity was computed assuming a gas turbine of 10,000 kw capability

	Steam Conditions (1 in. Hg)					Gas Turbine			
Curve	Psia	Temp, Deg F	Reheat	Feed-Water Heaters	Final Feed F.	Gas leaving Economizer, F	Reheat	Intercooler	Regenerator
A	1,265	950	No	4	352	452	No	Water 60 F	
B	1,665	1,000	No	4	372	472	No	Water 60 F	
C	1,665	1,000	No	6	524	...	No	Water 60 F	
D	1,665	1,000	No	5	524	...	No	Cond cooled	
E	1,665	1,000	No	5	524	...	Yes	Cond cooled	
F	1,665	1,000	No	5	524	...	Yes (2)	Cond cooled	Twin-Section
G	1,665	1,000	1,000 (1)	5	524	...	Yes (2)	Cond cooled	Twin-Section

(1) At 350-300 psia. (2) Separate combustion chamber for reheat.

to add a very large percentage of excess air either during combustion or after combustion, thus cooling the products of combustion without doing work and degrading heat.

In the steam cycle the products of combustion are also cooled, but the cooling is obtained in the generation of steam.

Cycle Combination Advantageous . . . Burns and Roe, Inc, has been studying the possibility of combining the two cycles by using the steam generator to cool the gas required by the gas turbine and using the steam so generated in the steam cycle. A very large number of heat rate computations have been made and some of the results are given in this article. These studies have been restricted to pressures and temperatures that have proved satisfactory in both steam and gas turbine operation. The results offer a highly efficient cycle using equipment which is available now, or, at least, equipment which is expected to become available sometime in the approaching future.

The heat available on this type of cycle for the production of steam power is high level heat, and therefore, there are no basic limitations on the steam cycle that may be used. It may be high pressure, high temperature, and may include reheat. A very efficient regenerative cycle may be combined with it.

Gains of 10 to 14% . . . In general, the properly worked-out combination of steam cycle and the gas turbine will show about 10 to 14% gain in thermal efficiency over the corresponding steam cycle without the gas turbine. One such cycle illustrated herein can deliver a net kilowatthour for 8,420 Btu, which is about 12% lower than any of the steam central stations now operating. With high pressures and temperatures this figure could be lowered, and an even lower heat rate may be expected. This cycle is illustrated in Fig 1. Slight modifications have been made in each of the seven studies discussed.

The air is admitted to the low pressure compressor and discharged to the high pressure compressor through an intercooler which uses the condensate of the steam turbine as a coolant. The high pressure compressor is provided with an extraction point from which air is led through a regenerator to a combustion chamber which acts as the reheater for the gas turbine. The remaining air passes through another section of the regenerator to the furnace of the steam generator.

Pressure-Tight Furnace . . . The casing of this generator is to be pressure-tight, possibly similar to that being used in the present pressurized furnaces, or as in some steamships. The gas leaving the generator passes through the high and low pressure turbines and exhausts through the regenerator.

The steam from the generator passes to a standard steam turbine. Five stages of extraction are provided in this study—the sixth heater being replaced by the compressor intercooler. The steam reheat is provided by the steam generator and the gas reheat by a separate combustion chamber. In Study E, the gas reheat is supplied by the steam generator.

Seven studies are included which show the effect of changes in cycle details and of furnace pressure. In all of them a gas turbine of 10,000 kw capability has been used and the

total capacity, gas turbine plus steam turbine, has been computed and plotted in Fig 2. The heat rates are plotted in Fig 3. In general the total capacity decreases with increase of furnace pressure; but the economy improves, the heat rates decrease. The division of work between the two turbines therefore becomes an economic problem. Any increase in cost due to higher furnace pressure must be justified by the reduction in annual fuel cost.

Present Technology Propitious . . . This combined cycle offers no serious development problems. Temperatures and pressures have been kept within conservative limits and no new alloys will be required. Some manufacturers are ready to accept orders for 10,000-kw gas turbines, and steam generators are already operating with pressures in the furnace above the atmosphere —as high as 25 psig in marine practice.

The pressure in the furnace will greatly increase the density of the gas passing through the convection zones and thus will increase the rate of heat transfer and reduce the required convection surface. The reduction in cost of boiler, superheater and economizer will somewhat offset the increase in the cost of the pressure casing. The higher cost per kw of the gas turbine over the steam turbine is offset by the smaller building required and no special design of steam turbine is made necessary. Although no detailed estimate has been made of the total installation cost for this combined cycle, the cost appears to compare favorably with that of the straight steam cycle of modern design. The saving of 10 to 12% of the annual fuel bill should more than justify any increase of cost for such a generating station incorporating the combination design.

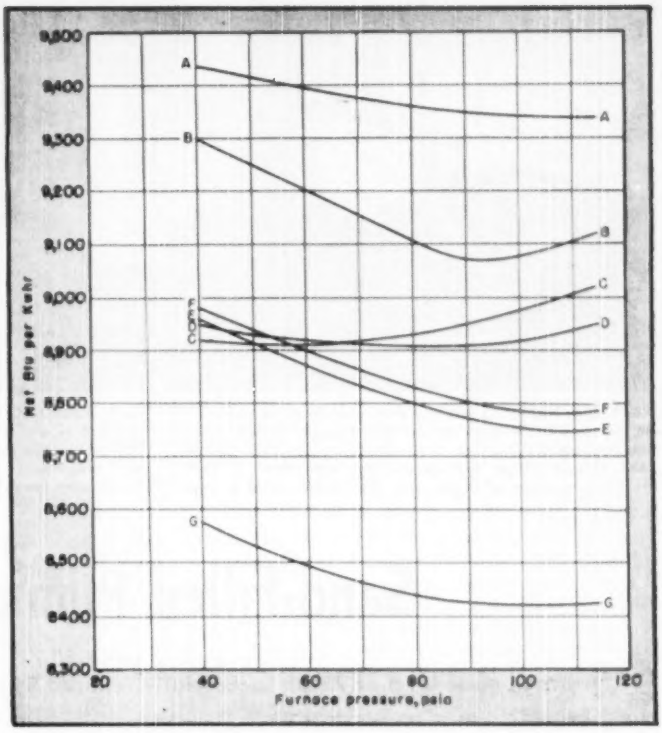
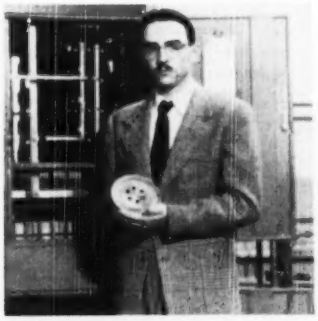


FIG 3—ECONOMY IMPROVES, but heat rates decrease, with increased furnace pressures. The greater costs brought about because of the higher pressure must be economically justified by a reduction in annual fuel cost



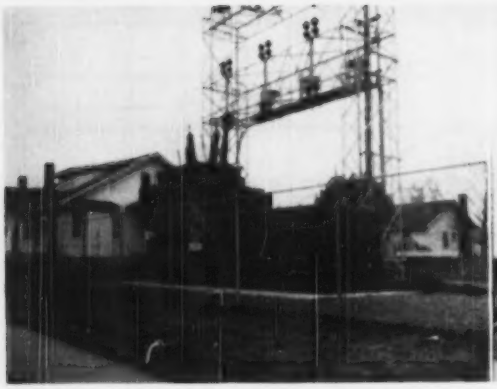
COPPER DISK, the heart of an experimental generator, is exhibited by R. I. Strough, the developer. Disk is driven by compressed air at a speed approaching 300 mph. The magnetic field developed is reportedly 6,000 times as intense as that of the earth's

Compressed Air Powers Generator

A whirling-disk-type electric generator driven by compressed air, which uses no iron in its magnetic circuit, has been built and undergone final tests. The machine was developed by Robert I. Strough, Standard Oil Fellow and Instructor in the Physics Dept at Case Institute of Technology, Cleveland, Ohio.

The disk is 5¾ in. diam and is made of beryllium copper. A jet of compressed air blowing against "buckets" cut into the disk whirls it at 17,000 rpm, or at a speed approaching 300 mph. Coil "windings" are not wound but cast of solid copper. Jets of liquid mercury are used for brushes. The energy of the copper flywheel is so great that solid metal brushes will not handle it without great loss.

The generator has reportedly developed a magnetic field 6,000 times as intense as that of the earth. A possible role for the unit is the magnetic core of a betatron or other atom-smasher. A limiting factor in the unit's capacity is the speed at which the disk will rotate before it flies apart. To prevent an accident the machine is surrounded by a heavy barrier of timbers and steel. Special equipment removes the toxic mercury vapors.



VIGOROUS PROTESTS resulted when average noise level of 71 db proved to be too much for residents adjacent to this 15,000-kva residential substation of Pacific Power and Light in Portland, Oregon. High daytime ambient noise level of heavy traffic gave effect of intensifying transformer noise at night

FOUR-WALL ENCLOSURE of hollow pumice blocks filled with sand and topped with a partial roof of tile accomplished an 18.5-db average reduction of noise level at the property line on all four sides of the station. Ventilation openings at bottom of wall were eventually closed. Total cost was $8,000

Sand-Filled Pumice-Block Walls

Average noise level of 71 db successfully reduced by enclosure of four walls, inner

CORBETT McLEAN, Supervisor of Engineering
Pacific Power and Light Co, Portland, Ore.

An 18.5-db average reduction in the noise level at the property line on all four sides of a 15,000-kva residential substation has been accomplished by Pacific Power and Light Co. The reduction in noise level was achieved by building an enclosure of pumice blocks filled with sand around the substation and topping it with a partial roof of tile.

In the fall of 1949 the company completed installation of a 15,000/25,000-kva, 110/66-11-kv unit type substation with four feeder positions in a residential district in the southeast section of Portland, Ore. This site was selected because of its: (1) Proximity to the load center, (2) size and availability, (3) zoning code restrictions and (4) ease of entrance and egress of transmission line tap and distribution feeders. It was a corner lot 70 x 95 ft on an arterial thoroughfare in a medium class residential district. To leave space for future duplexing of the station, the transformer section of the initial unit was placed at the east end of the property, relatively close to an adjacent frame dwelling, as shown.

Vigorous Complaints . . . When the unit was energized for service, residents in the adjoining area complained vigorously of disturbing noise. Sound level tests based on NEMA standards were made in cooperation with the manufacturer. Readings were taken at a number of points around the transformer at specified heights and at a distance of one foot from the major sound producing surfaces. They showed an average sound level of 71 db, with a maximum reading of 81.5 db. NEMA performance standards prescribe that for a 15,000-kva, 115-kv, oil immersed, self-cooled transformer average sound level shall not exceed 75 db when energized at normal voltage and frequency with no load. (In comparison, a 3,000-kva, 69-kv or less class OA transformer has a recommended NEMA average sound level of 65 db.) It is felt that this present NEMA noise level standard is so high that it is not realistic. Certainly it is paradoxical that a unit substation developed to operate outdoors and manufactured within prescribed noise tolerances should require an enclosure for its successful operation.

The noise problem was aggravated by a high daytime ambient noise level due to heavy traffic. It made the transformer noise at night seem even more intense. If the company was to avoid statute violation of a zoning ordinance, and to reestablish good public relations, need for some means of reducing noise level of the substation became imperative.

Barrier Only Solution . . . Extensive investigation of work done by other utilities, and information from manufacturers, local architects and jobbers of sound absorbing building materials, indicated that the only solution for a substation of such a high noise level was construction of a suitable wall or barrier around the unit to effect reduction of noise level at the locations of the complainants without interference

BAFFLE WALL supported by I-beam about midway of the enclosure extends from top of switchgear to top of enclosure. Wall has both acoustical effect and helps chimney action in enclosure

REINFORCED CONCRETE ROOF slab supports clay roofing tile. Wood nailing blocks in the concrete can be used for supporting internal insulation. Nails can be used directly in the pumice wall blocks

Cut Noise 18.5 db

baffle wall, partial roof on 15,000-kva substation

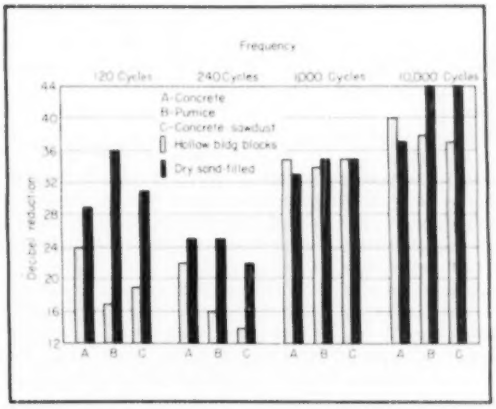
to the necessary ventilation and operation.

The investigation showed that two distinct problems—sound absorption and sound insulation—are encountered in working with sound. Sound absorption is concerned with dissipation of sound incident upon a surface. A material having a high absorption coefficient will permit minimum reflection and reduce reverberation. Sound insulation applies to reduction of sound intensity level transmitted through a structural wall. To reduce transformer noise by erection of walled enclosures is therefore a problem of sound insulation.

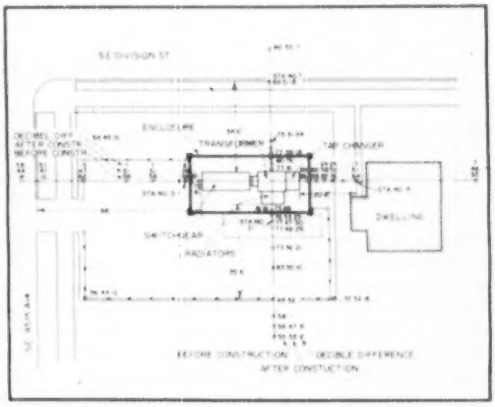
Many Materials Tested . . . A series of tests on various acoustical wood fiber, cork, glass fiber, and asbestos boards showed these lighter materials to be inefficient sound insulators. These tests and previously published information on efficiency of sound insulating walled enclosures indicated that materials having large masses were required for efficient sound reduction. For this reason tests using wet or dry burlap or canvas walls as sound insulators produced no noticeable sound reduction. Accordingly, various masonry blocks were tested.

Sound insulation ability of various blocks was tested with a directional noise source, a wall of the material under test, and a commercial sound measuring device. The noise source was a speaker enclosed in a heavy plywood box open on one side and lined with acoustical board, driven by an audio signal generator and amplifier. Sound intensity was measured before and after the sample wall was placed in front of the open side of the enclosure, the difference between readings being an indication of sound insulating efficiency of the material.

Sound insulation at the lower frequencies was noticeably improved by filling the hollow blocks with sand. Because of good sound absorption as well as good sound insulation, sand-filled pumice block construction was



MARKED REDUCTION of noise at the lower frequencies was shown by tests made on hollow blocks of different materials. Sound level due to speaker was measured on opposite side of the wall before and after filling the blocks with dry sand



NOISE REDUCTION along the property line varied from 15 to 24 db, averaged 18.5 db. Noise levels given in this diagram were taken before and after construction of the enclosure, at the locations indicated. Readings are plotted on the next page.

chosen for enclosure construction.

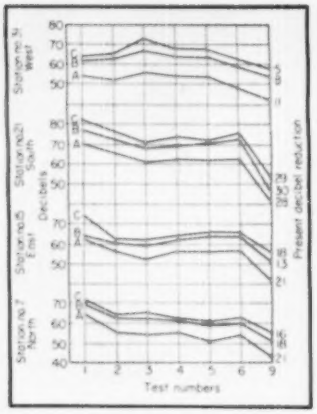
Additional study of sound absorbent materials indicated that pressed glass fiber panels of the type used for roof insulation would be the most suitable if additional sound absorption were necessary when building was finished.

Construction Used . . . Design of an enclosure approximately 47x24 ft with walls 16.5 ft high built of pumice blocks 8x8x16 in. and topped with a partial roof of tile was adopted. Reinforced concrete footing for the enclosure was poured independent of all other station structures and was physically isolated from them at all points. Cavities in individual blocks were filled with sand after every six or eight courses of blocks were placed. Clean, dry sand was used, well rodded to insure complete filling. Glass block panels added to the front wall for decorative purposes only, were backed with 4x8x16-in. blocks, also sand-filled, to provide full wall thickness at all points.

Pumice sand was used in the mortar to provide a material having nearly the same expansion coefficient as the blocks themselves. Steel reinforcing rods were placed longitudinally in the mortar joint between every third course of blocks to reinforce the wall structurally and provide a method of stopping expansion cracks which might develop. Walls were capped with a partial roof consisting of a poured reinforced concrete slab covered with clay roofing tile.

A baffle wall extending from 9 ft above ground to the top of the roof, parallel to and approximately midway between the ends of the enclosure, serves a three-fold purpose. It provides a wall close to the transformer for acoustical effect, supports the long span of the roof slab, and furnishes a division wall which helps chimney action in the enclosure by confining warm air around the transformer to a direct path upward. Ventilation openings were initially provided on three sides at the bottom of the walls, covered from direct access to the outside by a low baffle wall approximately 18 in. inside the main wall and 36 in. high. These openings were later closed off completely giving an appreciable improvement in attenuation external to the enclosure.

Wood nailing blocks placed in the concrete of the enclosure roof as poured can be used for supporting an internal lining of glass fiber insulation.



GREATEST IMPROVEMENT was measured after test 6, upon completion of partial roof and complete closure of ventilation openings on all sides. Previous tests were made: (1) Before construction; (2) average height of wall 5 ft; (3) average height 11 ft; (4) average height 15 ft; (5) wall completed to 16.5 ft, filled with sand. Curves A, B, and C are for a standard sound level meter equipped with frequency weighting networks providing scales which correspond to average frequency response of the human ear at levels of 40 db, 70 db, and 100 db. Locations of the four stations are shown in plan of station

A panel of blocks laid up in the front wall with vertical joints between pilasters can be removed to provide an exit for the transformer. A concrete beam spanning between these pilasters supports the roof over the opening, with sufficient vertical clearance to permit removal of the transformer minus bushings.

Effect on Sound Levels . . . Tests of sound level intensities at prearranged locations before, during and after completion of construction show by comparison the effect of various additions to the enclosure. Reduction of noise level at the property line on all four sides of the substation varied from 15 to 24 db, averaged 18.5 db. Completion of the roof and closure of the ventilating openings alone reduced the level an average of 13 db.

Tests prior to construction of the enclosure indicated little earthborn vibration, but frequencies transmitted through the air ranged from 120 cps to 1,560 cps and higher. Variation of the predominant frequency depending on what side of the transformer the measurements were taken indicated that auxiliary equipment on the large unit produced local sound sources of varying frequency and intensity.

Conclusions . . . Transformer noise in residential substations has become a major problem for electrical utilities because of several factors. Most important are the rapid increase in population and load density, requiring larger transformers; scarcity of suitable substation property; the practice of working new oriented or cold-rolled core steel to a high flux density; and noise consciousness of the general public. The low-frequency transformer hum is apparently a noise to which the average resident has not been accustomed.

On the basis of experience gained through this attempt to solve the problem of transformer noise level, the following suggestions are offered for installations in a residential area.

1. Continue to press the manufacturers for more uniform assembly with noise level an important feature in the design.

2. Procure enough property so the transformers can be placed at least 100 ft from the nearest dwelling.

3. Compare additional cost of a quieter transformer with construction of a sound insulating enclosure. On the basis of a premium of 25% for a transformer 10 db below NEMA levels, a 20% reduction on noise level might increase transformer cost by 50%. Several enclosures could be built for this high premium. Consensus of the industry appears to be that the best procedure is to energize the unit and then apply remedial measures if required. Extreme variation in sound levels of identical unit substations received under the same purchase order is a strong factor in this argument.

4. If an enclosure is economically advisable, select for its construction available material that has the lowest sound transmission factor and at the same time the highest sound absorption coefficient.

5. If possible, energize the transformer two weeks before construction of enclosure is started in an effort to accustom the neighborhood to the noise and obtain a psychological advantage as well as actual noise reduction when the enclosure is completed.

6. Improve substation appearance as much as is economically possible by landscaping and painting structures.

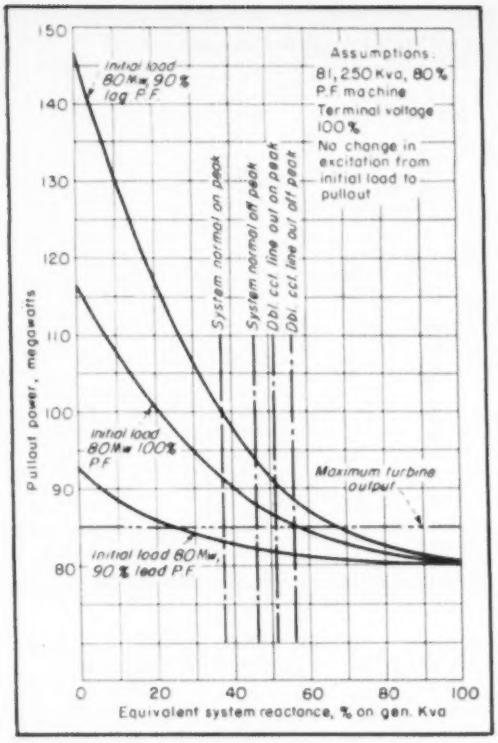

Assumptions:
81,250 Kva, 80% P.F machine
Terminal voltage 100%
No change in excitation from initial load to pullout
Initial load 80 Mw, 90% lag P.F
Initial load 80 Mw, 100% P.F
Initial load 80 Mw, 90% lead P.F
System normal on peak
System normal off peak
Dbl. ckt. line out on peak
Dbl. ckt. line out off peak
Maximum turbine output
Pullout power, megawatts
Equivalent system reactance, % on gen. Kva

FIG 1—PULL OUT POWER decreases as system reactance increases or as machine power factor increases in leading direction (terminal voltage constant) or as system reactance goes up

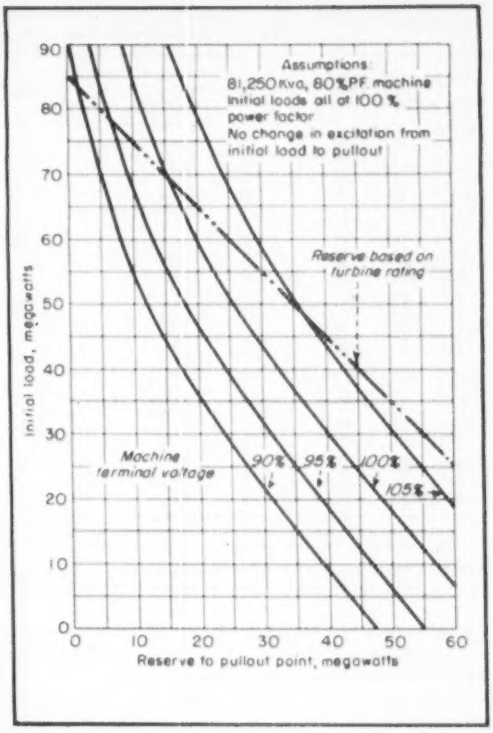


FIG 2—RESERVE TO PULL OUT of a typical generator increases as machine terminal voltage is increased and as the initial machine load in megawatts decreases

Are Today's Higher System Power Factors A Threat to Generator Stability?

Here is what a survey of 24 utilities disclosed about system load power factor and generator stability when operating in the under-excited region. Data covers 375 units totaling 14,396,000 kva

WILLIAM G. DEMPLER, Duquesne Light Co, Pittsburgh, Pa.

During the past few years many electric power systems have experienced a gradually increasing system load power factor chiefly as a result of: (1) More extensive use of high voltage cable and long high-voltage overhead lines, (2) greater use of static capacitors — particularly unswitched—for load capacity and voltage improvement and (3) greater use of static capacitors by customers for voltage improvement and to take advantage of a more favorable rate (power factor clause). All of these factors have increased, toward 100%, the operating power factor of individual generators. In most cases this increase has been greatest at light system load. This introduces a problem of generator stability while operating in the under-excited region. Basically this problem is one of steady-state and not transient stability.

The Systems Operations Committee of the Pennsylvania Electric Association felt it was desirable to explore some of the present practices and experiences of the operating companies in Pennsylvania and the neighboring states in respect to this problem and

TABLE I—Annual System Peak Load by Classes of Service for 24 Utilities Surveyed

Company	Avg System Load P.F. (%)* On Peak	Off Peak	Res'l & Com'l % Peak	P.F. (%)**	L. T. Industrial % Peak	P.F. (%)**	H. T. Industrial % Peak	P.F. (%)***	Other % Peak	P.F. (%)	Miscellaneous % Peak	P.F. (%)
1	95	98	25	90	30	90	30	92			15	.....
2												
3	83-88	96	75	87	10	80	5	80	10 (RR)	95		
4	81	77	53	89			33	70	7 (RR)	100	7	.....
5	88	85	38	94	12	98	41	95	8 (RR)	92	1	70
6	90	83	40	.....	34	.....	.....	.....	25 (Other Util)	.....	1	.....
7	91	90	75	85	25	90 (Inc H.T.)	.....	.....	.....	.....	.....	.....
8	83	76					.....	.....	.....	.....	.....	.....
9	86	90					.....	.....	.....	.....	.....	..
10	95	99					60	98			.....	..
11	85	93	45	85	50	80 (Inc H.T.)					5	80
12	80-85	90-95	60	90	10	80	30	90				
13	92	90										
14	83	79										
15	90	87										
16	93	84-86	39	92	9	85	52	94				
17		96										
18	90	94	16.1	87 (Res only)	13.2	87 (Inc com'l)	46.9	93	15.7 (RR)	100	8.1	92
19	90	95										
20	88	80										
21	88	90	40	85	22	80	13	80	5 sta aux	85	20	
22	95	94	50	95	37	85 (Inc H.T.)	.....	.....	13 (RR)	90	.....	.....
23	92	93										
24	94	92	35	90	35	95	25	95			5	90

* As measured at the power station.
** As measured at the distribution substation.
*** As measured at the customer's bus.
All power factors lagging.

subsequently, prepared and distributed two questionnaires on this subject. This article summarizes the information received in reply to these questionnaires.

Information for this study was contributed by 24 operating companies representing, in territory, most of Pennsylvania, New Jersey, New York, Maryland, District of Columbia, and parts of New England and Missouri. In all, 375 major generating units totaling 14,396,000 kva of generating capacity were reported.

Observations In Brief . . . While it is not possible in a general study such as this to make specific recommendations regarding this problem of steady-state stability, the following general observations may be made:

1. Steady-state stability reserve is a function of all the electrical characteristics of the individual machine and the system as a whole. It cannot be accurately measured by machine operating power factor alone. However, power factor can be used as a rough indication of stability.

2. Approximately 46% of the systems surveyed have a higher off-peak than on-peak system load power factor. It is this group that will probably be faced with steady-state stability problems before those having a lower off-peak power factor.

3. Closer coordination will be required, in the future, between system load reactive requirements and individual area reactive and voltage control by static capacitors.

4. Power factor clauses in rate structure provide an effective means of controlling customers' load power factor. But they should be re-examined periodically to insure that they meet changing systems reactive requirements.

5. During the past 10 years in the group covered by this survey, there have been no major cases and only four relatively minor cases of generator instability directly or indirectly due to underexcited operation. This indicates that present limits could be raised if necessary without increasing materially the frequency of instability.

6. On the average, newer generators have a lower short circuit ratio than older machines. However, newer machines are more stable due to their more modern throttle and voltage regulating systems. In general, operating power factors and limits of newer machines are nearer unity than older machines.

7. As steady-state stability problem becomes more critical a greater responsibility for stability will be placed upon automatic voltage regulators.

The Stability Problem . . . System stability may be broadly defined as that property of a system to remain in operating equilibrium through both normal and abnormal conditions. Advancements in the art of relaying and fault control have reduced the seriousness of transient stability; however, it is only in the immediate past that the question of steady-state stability has become critical. The primary concern here is steady-state stability for both normal and abnormal system conditions.

Relative stability of a generator depends upon the five factors:

1. Machine characteristics such as reactance, effect of saturation, type and range of voltage regulator, etc.

2. The kw and kvar load on the generator as well as the total system load. The lower the kw and the higher the kvar machine load the greater is the reserve to the pull-out point. By definition the load at the pull-out point is the maximum load with a given excitation that a generator can transmit to the system and still maintain synchronism.

3. Reserve to pull-out varies almost directly with the terminal voltage of the machine.

4. One of the major factors affecting the reserve to pull-out for any machine is the equivalent reactance

TABLE II – System Characteristics and Use of Capacitors

Company	Max System Load P.F. (Off-Peak)	Predominate System Load			Plans to add Apprec. Cond. Cap. to System	% New Cond. cap. to be switched	Any switching of present cond. cap. to control gen. P.F.	P.F. Clause in Rate Structure		
		Class	%	P.F.				Used	Upper Limit of Correction	% Load Affected
10	99	Industrial*	60	98	Yes	50	Yes	Yes	98	60
1	98.5	Industrial*	60	91.5	No		Yes	Yes	95	41
17	96	.....	...	...	.....			Yes	90	20
24	96	Industrial*	60	95	No		No	Yes	90	60
3	96	Res & Com'l	75	87	No		No	No	.....	...
23	95	.....	...	...	No		No	No	.....	...
19	95	.....	...	...	Yes		No	Yes	97	...
12	90-95	Res & Com'l	60	90	Yes		No	Yes	100	40-50
18	94	Industrial*	53	98	No		No	Yes	95	60
22	94	Res & Com'l	50	95	Yes	.....	No	Yes	100	33
11	93	Industrial*	50	80	Yes	90	Yes	No	.....	...
13	92	.....	...	...	Yes	0	No	Yes	100	35
16	92	Industrial*	61	92	No	.....	Yes	Yes	100	60
7	91	Res & Com'l	75	85	Yes	·50	No	Yes	87	5
21	90	Res & Com'l	40	85	Yes	1	Yes	No	.....	...
9	90	.....	...	...	Yes	80	No	Yes	90	...
6	87-89	Res & Com'l	40	...	Yes	33	No	No	.....	...
5	87	Industrial*	53	96	Yes	10	No	Yes	100	80
15	87	.....	...	...	Yes	95-100	Yes	Yes	100	60
20	80	.....	...	...	No	.....	.....	.....	.....	...
4	79	Res & Com'l	53	89	Yes	.....	No	Yes	75	.....
14	79	.....	...	...	Yes	.....	.....	.....	.....	.....
8	76	.....	...	...	Yes	.....	.....	.....	.....	.....
2	.....	.....	...	...	Yes	0	No	Yes	95	50

* Both high tension and low tension.
All power factors lagging.

between that machine and the other generators of the system. This will be determined in a large measure by the system transmission and the method of connecting individual machines to that transmission.

5. In general any abnormal system setup, such as lines out of service, will increase the equivalent reactance between generators and thus reduce their reserve to pull-out. Reduced system load resulting in generators being taken out of service will also increase this equivalent reactance.

Some of these effects are illustrated on Fig 1 where the pull-out power of a typical generator is shown for various initial loads and various system reactances. These curves illustrate the reduction in pull-out power experienced as machine power factor is increased towards the leading direction (terminal voltage constant) or as the equivalent system reactance is increased.

In Fig 2, reserve to pull-out of a typical generator is shown for various machine terminal voltages. It demonstrates the reduction in pull-out power with reduction in machine terminal voltage.

Many systems have used and are still using operating power factor, alone, as a measure of stability. In general, this type of rating is satisfactory if the particular system inherently has a large steady-state reserve or where the machines follow the same load and voltage cycles day after day. However, where load conditions are such that any of the machines are approaching their stable operating limit a power factor rating alone is often misleading and generally will prove to be inadequate.

It should not be expected that a survey such as this would completely answer the question of just how far one can safely go in the underexcited region of generator operation for any one particular machine. Each generator, of course, will have its own steady-state stability limit depending upon (as pointed out earlier) not only its own electrical and mechanical characteristics and its operating point but upon all the other system generators and system ties as well.

System Characteristics a Factor . . . The major factor fixing the system reactive requirements is, of course, the system load. Table I shows a breakdown of system peak load for each system by classes of service, as well as an estimated power factor for the total load and for each class of load. This table well illustrates some of the basic differences among utility systems. For example, residential and commercial load varies from 20% to as high as 75% of peak, while the industrial load (low tension and high tension) varies from 15% to 61% of the system load. A second point to note is that 11 out of the 24 systems have their highest system power factor during the off-peak period when the generator terminal voltage is reduced and the equivalent system reactance is high (generators off), thus making this period the most critical from a stability point of view.

Effect of Capacitors . . . It was pointed out earlier that one of the major factors that has raised the system power factor in recent years has been the greatly increased use of static capacitors for local voltage relief or to increase the load-carrying capacity of circuits. Most of these capacitors are unswitched and so represent, for the most part, a fixed leading reactive load on the system. Their effect on the system peak has not been too great, but at minimum system load they have in many cases raised the system load power factor several percent. Notwithstanding this, Table II shows that 75% of the companies surveyed have definite plans at this time to add an appreciable amount of capacitors to their system in the near future.

One way to minimize the effect of

TABLE III—Summary of System Power Factor Limits and Method of Reactive Control

Company	Generator P.F. Rating Used: None-Ind. Gen. or System-wide	Generator P.F. Rating Used: Limit %	Separate P.F. Limits for Machines with Automatic Voltage Regulation	Steps taken to Keep Generator P.F. Down (Where required)	Basic System of Voltage and Reactive Control
				Note 4	Note 5
1	Individual	Note 1	None	B-C-D	C
2	Individual	99	None	.....	D
3	None		None	F	A-F
4	System-wide	97	None	A-C	B
5	Individual	90-95	None	A	C
6	Individual	98	None	.....	A
7	Individual	95	None	.....	D
8	System-wide	100	None	.....	.....
9	Individual	98	None	A-C-D	C-D
10	System-wide	99	None	A-C-D	C
11	None	.....	Note 3	B-C-D	B-C-D
12	Individual	100	Yes-based on excitation	.....	A-E
13	System-wide	100	None	A	A
14	None	.....	None	.....	.....
15	System-wide	95	None	A-C-D	A
16	System-wide	96	None	A-C-E	C
17	None	.....	None	C	A
18	None	.....	None	B	B
19	Individual	95-98	None	D	A-C
20	None	.....	None	.....	.....
21	Individual	91-95 (Note 2)	Yes-90% without Reg.	C-D	D
22	None	.....	None	D	C
23	None	.....	None	.....	A
24	Individual	97.5-100	None	B-D	A

All power factors lagging.

SUPPLEMENTAL NOTES

Note 1. Limit is based on reactive load or minimum field. Example 100,000 kva machine—limit 20,000 kvar to the machine or field current of 400 amperes.

Note 2. Limit based on minimum field to provide given pullout power against an infinite bus.

Note 3. Do not operate machine without automatic voltage regulators.

Note 4.
- A. Raising the voltage above that desired.
- B. Curtailing generator kw load involving deviation from economic schedule.
- C. Underexcited operation of synchronous condensers.
- D. Manual or automatic switching of static capacitors.
- E. Dispatching of reactive over the interconnections.
- F. Transfer of reactive between stations by tap changing under load equipment.

Note 5.
- A. Power stations following relatively fixed individual voltage schedules with little regard, within limits, to the reactive loading.
- B. Power stations following relatively fixed individual voltage schedules with generator reactive loading controlled as far as possible by the system operator.
- C. System voltage controlled by the system operator with the generator reactive loading controlled within limits by the power station operator.
- D. System voltage and generator reactive loading controlled by the system operator.
- E. Generator reactive loading regulated within overall voltage limits.
- F. Reactive transfer between stations controlled by tap changing under load equipment following normal schedules.

these capacitors during the off-peak period is to provide automatic switching. This is, of course, more expensive. Of the systems surveyed, the percentage of capacitors to be installed with switching varies widely, from 0% to 100%, but in most cases the switching will be controlled by local voltage requirements and not generator reactive load. However, six systems have provided switching on some of their condensers to control generator power factor.

Customers too have found it advantageous to add static capacitors, both to improve voltage regulation within their plant and to take full advantage of power factor clause in the rate structure. Most of these capacitors are unswitched. Moreover, being customers' equipment they are difficult to control by the power system. Nevertheless, two systems (No. 6 and No. 10) have made some requirements of their customers for off-peak switching of capacitors. It is anticipated that other systems will be forced to make similar requirements in the future.

Power Factor Clauses . . . In the early development of the industry, many systems suffered from loads with abnormally low power factors. This gave rise to some form of power factor clause in the rate structure. A majority of these original rates provided power factor correction to 100% and many systems subsequently found this limit too high and have revised it downward.

Table II shows that 16 systems out of the 24 have some form of power factor clause in the rate structure and the upper limit of correction varies from 75% to 100% with an average of 94.5%. The percent of the system load affected by these power factor clauses varies from a minimum of 5% to a high of 80%. The survey also showed that no system penalized customers for a leading power factor load.

Power Factor Limits and Reactive Control . . . Table III summarizes the various types of power factor ratings and methods of reactive control used. It is observed that: (1) Ten systems provide separate ratings for individual machines, (2) six systems utilized a common limit for all the generators on the system and (3) eight systems have set no power factor limit. Possibly some of this latter group utilize a minimum field current and limit reactive. However they have not so reported. Others probably regulate primarily for voltage and beyond determining that the present operating range of reactive load provides adequate reserve from a stability standpoint do not set a power factor limit.

Only two systems have in effect discarded the power factor ratio as a limit and have set limits based on actual reserve to the pullout point.

As has been stated, use of a power factor as an operating limit is probably adequate for machines that have a more or less fixed operating schedule day after day. Moreover, power factor alone does not provide a complete measure of the relative steady-state stability of any particular machine.

Many studies and tests have demonstrated that this steady state reserve can be greatly increased by the use of properly-coordinated automatic voltage regulators. However, only three systems provide separate limits for machines without automatic voltage regulators. Greater dependence on this type of automatic equipment to maintain system stability will undoubtedly be made in the future.

In respect to the method of reactive control used, some nine systems reported the power stations following relatively fixed individual voltage schedules with little regard, within limits, of the reactive loading, while eight companies reported the system voltage controlled by the system oper-

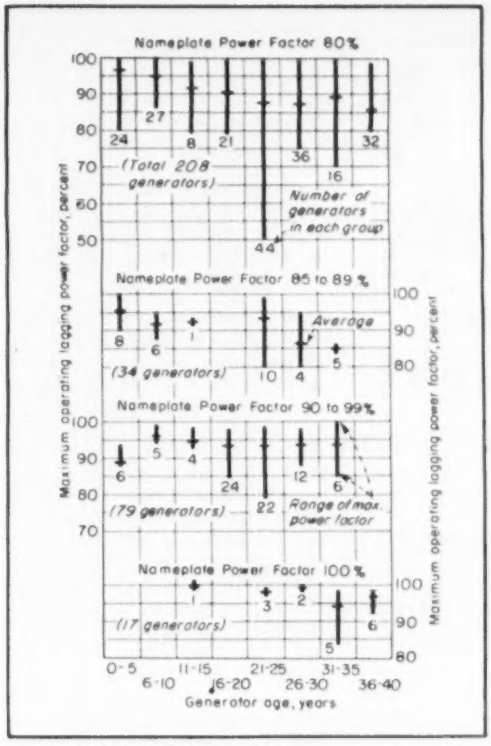


FIG 3—GENERATOR AGE and the variations of maximum generator operating power factor and nameplate power factor (lagging) for the 338 machines surveyed are depicted here

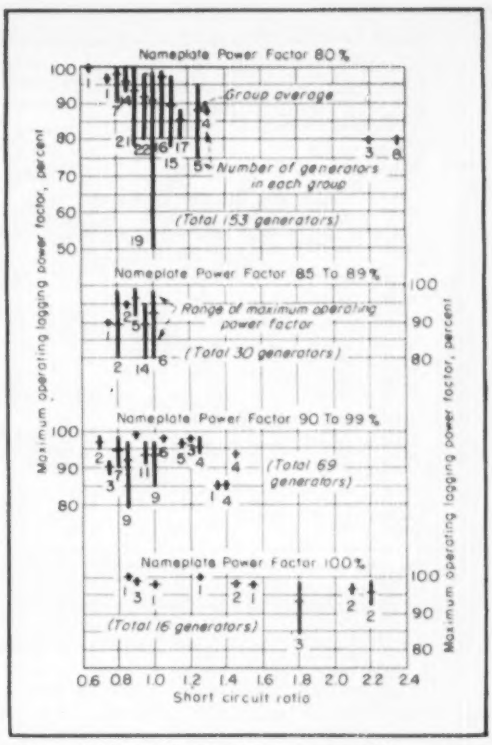

Nameplate Power Factor 80 %
Group average
Number of generators in each group
(Total 153 generators)
Nameplate Power Factor 85 To 89 %
Range of maximum operating power factor
(Total 30 generators)
Nameplate Power Factor 90 To 99 %
(Total 69 generators)
Nameplate Power Factor 100 %
(Total 16 generators)
Maximum operating lagging power factor, percent
Maximum operating lagging power factor, percent
0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4
Short circuit ratio

FIG 4—SHORT CIRCUIT RATIO compared with maximum generator operating power factors and nameplate power factors. Short circuit ratios vary from 0.65 up to 2.35

ator with the generator reactive loading controlled within limits by the power station operator and finally, five companies have the system voltage and generator reactive loading both controlled by system operator.

System Operation . . . Only 4 systems out of 24 reported instances of instability during the past 10 years where under-excited operation was a major contributing cause. System No. 10 has had some small units 60 to 80 miles away from the base load plant pull out of step. No. 11 reported motoring at one of their hydro plants during the light-peak period. No. 17 had two machines pull out of step due to a sudden loss of a major block of reactive load on one of its interconnections and lastly, No. 18 reported a case of momentary instability on a 60- to 25-cycle frequency changer when the voltage regulator on a 25-cycle generator stuck open.

From this excellent record it is apparent that the present excitation on power factor limits hold little danger of instability and suggests that many systems could probably raise their present limits materially without increasing the likelihood of instability.

In this connection, three systems have made a major change in their general policy on generator power factor limits during the past few years. System No. 1 has set on its 100,000 kva 80% pf machines new limits of 20,000 kvar to the machine or a minimum field, whichever is reached first. No. 15 has raised the power factor limits on their newest generators. And No. 21 has established minimum field based on calculated pull-out against an infinite bus for machines with automatic voltage regulators.

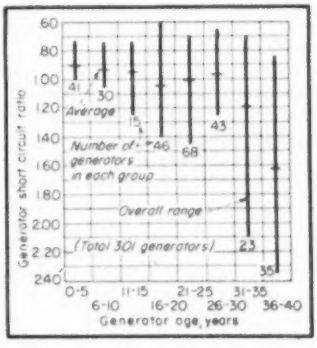


FIG 5—GENERATOR AGE compared with nameplate short circuit ratio

Power Curtailment . . . Despite the small number of systems that have revised their power factor limits, only two companies have found it necessary to curtail power loading on any of their generators in order not to exceed the upper power factor limit on that particular machine. No. 17 must limit the high power factor operation on one machine due to end finger heating, and No. 21 must curtail kw

TABLE IV — Operating Power Factors and Limits of Individual Machines

Company	Operating Power Factor Range and Power Factor Limits							
	Generators with Auto. Voltage Regulators				Generators without Auto. Voltage Regulators			
	Weekdays		Weekends	Limit	Weekdays		Weekends	Limit
	On Peak %	Off Peak %	%	%	On Peak %	Off Peak %	%	%
1	96	100	.....	*	.....	.....	.....	.....
2	93-97	49-97	90-98	99	.....	.....	.....	.....
3	.....	.....	.....	.....	88-99	78-100	.....	**
4	88	88	90	97	80-96	85-96	80-97	97
5	79-91	79-94	62-95	90-95	.....	.....	.....	.....
6	.....	.....	.....	.....	78-100	78-100	78-100	98-100
7	80	85	.....	95	77-92	70-86	69	95
8	50-95	70-80	.....	100	.....	.....	.....	.....
9	.....	.....	.....	.....	70-90	49-90	75-95	98
10	90-97	99	99	99	.....	.....	.....	.....
11	75-100	75-100	70-99	None	.....	.....	.....	.....
12	70-80	90-100	80-100	100	80	90	90-100	100
13	80-90	75-99	80-100	100	.....	.....	.....	.....
14	70-85	65-98	.....	None	.....	.....	.....	.....
15	80-94	95-98	95-99	95-100	75-85	90-95	90-95	95
16	95	90	80-85	96	.....	.....	.....	.....
17	79-93	70-95	70-98	None	82-98	82-98	84-99	None
18	86-99	76-991	57-99	None	96-97	85	.....	None
19	90-95	80-94	50-90	95-98	95	.....	.....	95
20	88-93	78-92	.....	None	.....	.....	.....	.....
21	80-95	70-95	75-95	95-96	85-93	86-90	70-91	93-95
22	45-97	47-97	83-99	None	85-96	75-88	95-96	None
23	69-98	50-100	70-100	.....	79-94.3	65-99	71-96	.....
24	80-95	96-97	.....	97.5-100	95	70-97	.....	99

Note: All power factors lagging. * Set by minimum field or maximum reactive flow to the generator. ** Power factor limit varies with the kw load.

load occasionally on machines with the automatic voltage regulator out of service in order to stay within their established 90% power factor limit.

The stable operating limit of a generator is a function of the reactance between that machine and the other machines on the system. Two companies have reported system changes to lower the reactance between power stations in order to raise their stable operating limit. No. 4 has removed series reactors in their 33-kv station tie cables and No. 17 has reactors at their hydro station which are put in service during light load periods to lower customers' voltage and permit relatively high generator excitation.

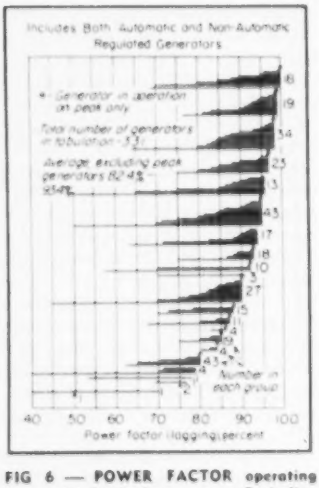


FIG 6 — POWER FACTOR operating range of individual generators. Excluding peak load machines, range is from 1–2% up to 50%. Average operating range was between 82.4 and 93.4%

Table IV shows the over-all operating power factors of the individual machines together with their power factor limits. This table brings out the fact that practically no differentiation, in general, is made in operating power factor or power factor limits between machines with automatic voltage regulators and those without automatic voltage regulators.

Generator Characteristics . . . Nameplate power factor of a generator should correspond approximately to the expected operating power factor. A generator with a low power factor rating that is operating at a high power factor is less stable than a unit of the same size rated more nearly at the operating power factor. Today the standard is toward an 85% lagging power factor machine with a short circuit ratio of 0.8.

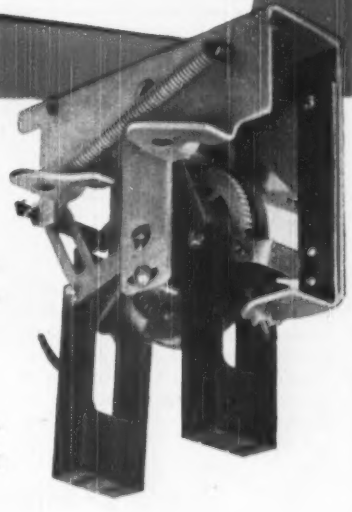
Fig 3 compares maximum machine operating power factor with the age of the machine and its nameplate power factor. Of the 338 machines represented, 61.5% are 80% nameplate power factor machines. Practically all nameplate power factor groups have machines operating up to 100% and the average maximum power factor for each group approaches 100% as the age of the machine decreases. This, of course, is basically the result of higher loads on the newer machines to decrease generation costs.

Short Circuit Ratio . . . Generator short circuit ratio depends upon synchronous reactance and no load saturation, and is often used as a measure of stability. Short circuit ratio is also an indication of the machine size for a given rating; the higher the short circuit ratio the larger and more expensive the machine.

Machines with a high short circuit ratio are the more stable and better able to pick up a large block of load with little or no change in excitation. Thus for machines having manual or very slow automatic control of excitation a high short circuit ratio is desirable. This advantage is largely offset, however, where modern automatic voltage regulators are installed. In most cases a machine with a relatively low short circuit ratio having a properly coordinated automatic voltage regulator is more stable than a machine with a higher short circuit ratio with manual control of excitation.

On Fig 4 is shown a comparison of the short circuit ratios, maximum operating power factors and the nameplate power factors. As to be expected there is a rather wide range of short circuit ratios, varying from 0.65 to as high as 2.35.

It is notable that, for the 80% nameplate power factor group, average maximum operating power factor increases toward unity as short circuit ratio decreases. From a stability standpoint one would expect maximum operating power factor to decrease with a decreasing short circuit ratio. This conflict is partially explained by Fig 5 which, by comparing short circuit ratio and machine age, shows that newer machines have on the average a lower short circuit ratio. These newer machines, for the most part have modern automatic voltage regulators and hence are more stable than older machines with slower or no excitation control.



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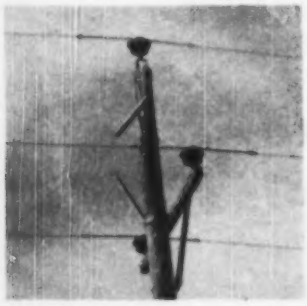
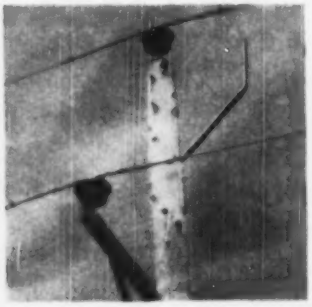


OLD METHOD of providing ground path for lightning surges resulted in loss of top insulator and pole top burning



NEW PRACTICE uses offset gap to shunt surge around insulator. Impulse strength of wood is more effectively utilized

IMPROVEMENT on new practice consists of extending armor rod and installing aluminum clamp vertically over bracket

Offset Gap Saves Insulators and Pole Tops

B. E. ELLSWORTH
Chief Electrical Engineer
Platte Valley Public Power and Irrigation District
North Platte, Neb.

Earlier practice (above) on 3-phase, 34.5-kv, triangular-positioned transmission lines of Nebraska Public Power System consisted of gap in conjunction with pole-top conductor to approximate protection afforded by overhead ground wire in conventional transmission line construction.

But this method had two disadvantages: (1) Pole-top insulators were frequently shattered by lightning surges and top of poles were burned by power follow current, even when backed up by Petersen coils; (2) impulse strength of pole was not effectively used.

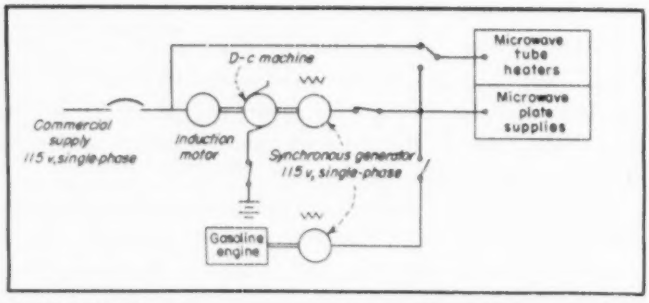
New construction (above) was effected by continuing the 10-in. gap from the conductor but offsetting the bracket so as to utilize the impulse strength of the wood. Operation of this type of protection has been very good when backed up with a Petersen coil.

An improvement of the new type of construction (above) was made by extending the armor rod and reinforcing it with a heavy aluminum clamp vertically over the gap. This improvement has produced better results, particularly less burning of top conductor. Reclosing relays are used on all lines which are not afforded protection by Petersen coils.

Transfer Microwave Load With No Interruption

T. W. STRINGFIELD
Electrical Engineer
Bonneville Power Administration
Portland, Ore.

Storage batteries and a three-machine motor-generator set will provide Bonneville Power Administration with continuity of operation during transfer of microwave relay equipment from normal to emergency power supply. This type of emergency power was chosen because, primarily, the microwave system provides the equivalent of pilot wire circuits for relay protection of the 230-kv transmission



POWER SUPPLY for microwave repeater stations provides continuous power during transfer from normal to emergency supply. Circuit is shown for normal operation

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Apparatus Dept., General Electric Co., Schenectady 5, N. Y.

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system. It is therefore essential that the microwave system operate without momentary interruption even at the time of system fault.

Batteries and motor-generator set for emergency power are shown in the simplified sketch. Because the microwave equipment can operate down to 50 cycles, an induction motor is used to drive the dc machine and synchronous generator. Under normal conditions only microwave plate load is supplied from the m-g set. Microwave heater load is supplied directly from the commercial power source. This segregation of load reduces the size of the induction motor required to drive the set and reduces starting duty on the single-phase supply. This reduction in size is advantageous because microwave stations generally are located in remote regions where only single-phase power is available. In these locations, induction motor starting load becomes an important or limiting factor.

Transfer from normal to emergency power is as follows: Upon failure of the commercial source the dc machine begins to motor and drives the synchronous generator, maintaining an uninterrupted supply to the plate load. Tube heater load is simultaneously transferred to the m-g set, which is capable of supplying full load of equipment. Thermal storage of the tube heaters prevents an interruption of circuit during this transfer.

After a predeterminded time delay of about 10 min, the entire load is transferred to a conventional gasoline-driven generator set and the m-g set disconnected from the battery. That the dc plate supply is momentarily disconnected during this switching operation is of no consequence since it happens after the emergency has occurred. After a suitable waiting period, following restoration of the normal power source, the m-g set is automatically started from the battery, the gasoline set shut down, and the circuit restored to normal.

Microwave load requirements at repeater stations vary from 3.5 to 15 kw, depending on type and size of station. Installations of emergency power sources will be made throughout the entire microwave system, consisting of about 23 repeater stations.

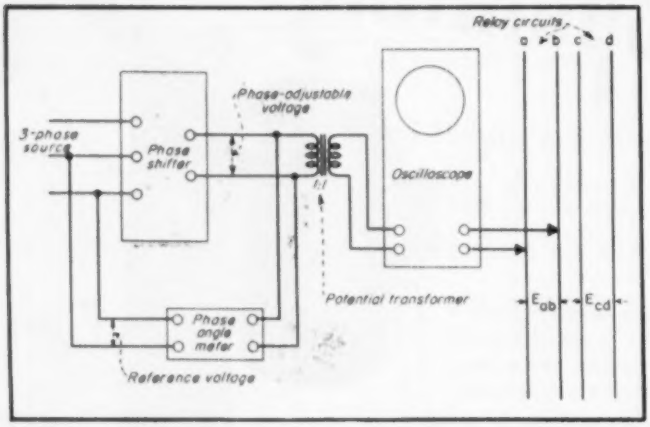

FIG 1—OSCILLOSCOPE and associated circuit components, for measuring phase angle between relay circuits where instrument burden of conventional phase angle meter used alone would greatly disturb quantities to be measured. This circuit measures phase angles between two voltages and a constant reference voltage. Desired angle between relay voltages is difference between measured angles

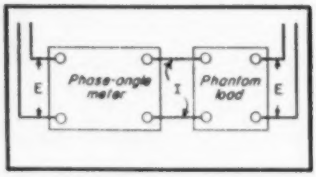

FIG 2—MODIFIED CIRCUIT for utilizing phase angle meter which indicates angle between voltage and current only

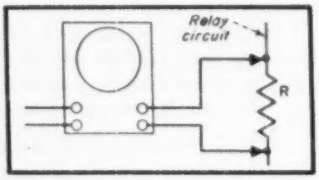

FIG 3—PHASE ANGLE of unknown relay current is determined by inserting or utilizing resistor of proper value

Measure Phase Angle in Relay Circuit Accurately

J. R. EATON

Purdue University
Lafayette, Ind.

J. S. RACE

Consumers Power Co
Jackson, Mich.

Phase angle measurement in certain relaying circuits, where the instrument burden of a conventional phase angle meter would greatly disturb measurable quantities, may be made quite readily and with fair accuracy with a circuit built around a cathode ray oscilloscope. This circuit measures phase angle between each relay voltage or current and a constant reference voltage. Desired angle is then computed from this information.

The circuit (Fig 1) has been used extensively by the authors in studying relay circuit performance, particularly in tests involving settings of bushing potential devices.

Procedure for determining phase angles is as follows: Assume that we wish to measure the phase angle between voltage E_{ab} and voltage E_{cd} in Fig 1. A connection is made from wires a and b to the X-axis input terminals of the oscilloscope. This voltage produces a horizontal deflection of the trace, magnitude of which may be adjusted by X-axis amplifiers. The Y-axis is fed by a phase adjustable voltage through the potential transformer at oscilloscope terminals. Phase position of the phase adjustable voltage may be shifted until oscillo-

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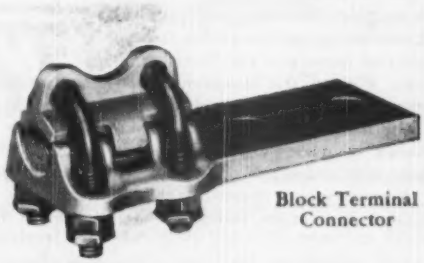
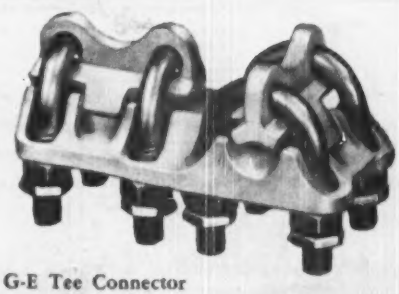


Block Terminal Connector



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scope trace indicates that this voltage is in-phase with voltage E_{ab}. The angle between the phase adjustable voltage and a constant reference voltage is measured by the standard phase angle meter.

Next, connect the X-axis terminals to wires c and d. Readjusting the phase shifter will place the phase adjustable voltage in phase with voltage E_{cd}. Phase angle meter will read the angle between voltage E_{cd} and reference voltage. Phase angle between voltages E_{ab} and E_{cd} is the difference between the two phase-angle meter readings.

A potential transformer (Fig. 1) is necessary when the oscilloscope has a common ground connection through the case between X and Y-axis terminals. Without this transformer, terminals on which measurements are being made will be electrically connected to phase-shifter output, perhaps with undesirable results.

Certain types of phase-angle meters, built to read angles between voltage and current, require the phase-angle meter part of the circuit to be modified as in Fig 2. A phanton load converts phase adjustable voltage into a current of proper magnitude for operation of the meter. Any angular errors in the phantom load or in the potential transformer are constant and will not affect the accuracy of readings.

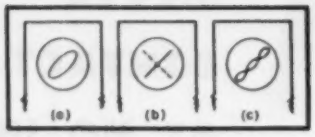
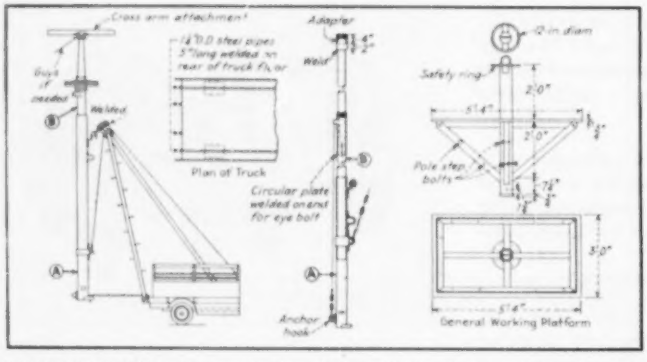


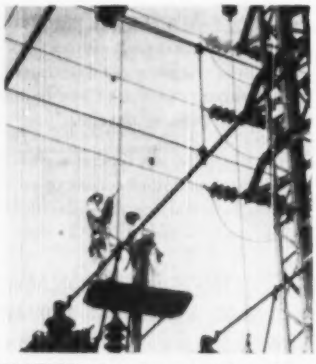
FIG 4—TRACES on oscilloscope are indications of phase angles between relay voltage and phase-adjustable voltage. Out-of-phase voltages produce elliptical trace (a) in-phase voltages of approximately equal amplification produce straight line trace at 45 deg with horizontal, or trace indicated by dotted line if they are 180 deg out of phase (b); harmonics on X or Y-axis plates produce distorted trace (c). This figure will not reduce to straight line; however, reference voltage and relay voltage fundamental may be reasonably matched by equalizing alternate loops

Angles between unknown currents and reference voltage may be measured with the oscilloscope circuit provided a resistor of proper value is already present or may be connected in the circuit (Fig 3) without disturbing phase positions. Magnitude of this resistor will depend upon current flowing in the circuit and on X-axis deflection sensitivity. Whether or not this resistor imposes too much burden on the circuit for accurate phase angle measurement will depend on total circuit resistance.

When measuring phase angles, the oscilloscope should be operated in a location free from disturbing ac magnetic fields of power conductors. Magnetic field influence may be tested by short-circuiting X and Y-axis terminals. If the oscilloscope trace reduces to a point, no disturbing fields are present; if trace is a line, the oscilloscope should be relocated.



TELESCOPING POLE supports circular platform (left). Three sections of pole as extended (center). Working platform (right) used in place of crossarm attachment



PLATFORM has ring to which workmen can attach safety belts when working

Overhead Work Done Safely With Telescoping Pole

W. P. CARTER
System Transmission Line Supt
Appalachian Electric Power Co
Bluefield, W. Va.

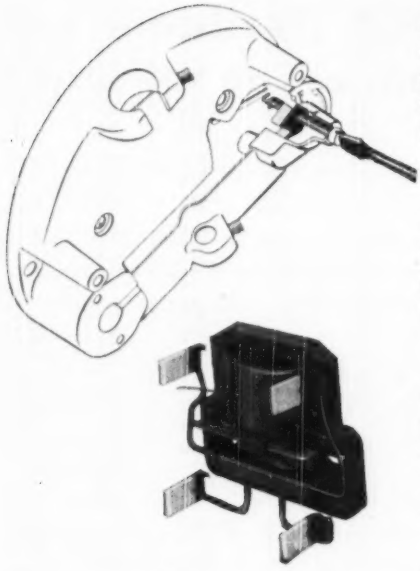
Use of a telescoping pole and platform, in conjunction with trucks equipped with a pole derrick and winch, has permitted the safe accomplishment of overhead "hot" jobs that would not have been attempted otherwise.

Here are some uses of the telescoping equipment: (1) To provide a working platform on which men can safely handle jobs 17 to 60 ft above ground; (2) to provide ample space for safely maneuvering hot sticks and other necessary tools during hot-line work; (3) to make repairs to mid-span points of overhead conductors and still maintain sufficient clearance above highways, railroads and foreign lines; (4) to safely wash insulators carrying "hot" conductors and provide adequate space between the hose nozzle and insulators against which the high-pressure water stream is directed. Additional precautions, such as pre-testing conductivity of water and grounding hose nozzle, are employed; (5) to lift a complete distribution circuit clear of poles for replacement of crossarms, insulators, poles or revamping of pole-top assem-

(Continued on page 134)

Be thrifty - use the I-50

THERE'S LESS TO ADJUST!



A fraction of a dollar spent on watthour-meter adjustment—multiplied by the number of meters you own—can add up to a sizable unnecessary expense. With the I-30, exacting factory tests provide correct calibration, and unit construction assures that this calibration will be maintained. Here's how:

Permanent, stable characteristics reduce the need for service adjustments to extremely narrow limits. A refined micrometer adjustment provides all the range ever needed. Conventional meters, with more chances for error, require larger ranges and coarser adjustment.

Unlike conventional meters, no adjustments need be made for lagging power factor, thus none is provided for. The exclusive unit construction of the electromagnet—with all parts *permanently* fixed in place—makes a permanent factory adjustment of the lag plate possible.

time to retire ... old watthour meters?

It may cost you more to keep an old watthour meter in service than to replace it with a modern I-50. Here are the reasons:

1. **LOSS IN REVENUE AT INCREASED LOADS**
2. **EXCESSIVE OPERATING EXPENSE**
3. **HIGH COST OF REBUILDING AND MODERNIZING**

Adopt the I-50—today's most modern meter—as your *standard*. It *earns* more—by accurate overload registrations. It *saves* more—by its design for fewer adjustments, less maintenance. Ask your G-E representative for full information. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

GEI-55

Relation of Kilowatts, Kilovars and Power Factors for Circuit Studies

R. W. BURRELL, Engineer, Transmission and Distribution Bureau
Consolidated Edison Co of New York, Inc

Table provides a ready means for establishing the relationship of kilowatts, kilovars and power factor for use in electric circuit studies. It is equally suitable for use in billing commercial and industrial customers. Kw and kvar are the usual measured quantities. Power factor, and corresponding kva, are easily determined. Examples show the use of the table

% P. F.	Kvar in % of Kw	% P. F.	Kvar in % of Kw	% P. F.	Kvar in % of Kw	% P. F.	Kvar in % of Kw	% P. F.	Kvar in % of Kw	% P. F.	Kvar in % of Kw
100.0	0.0	95.0	32.9	90.0	48.5	85.0	62.0	80.0	75.0	70.0	102.0
99.9	4.5	94.9	33.2	89.9	48.8	84.9	62.2	79.8	75.5	69.5	103.4
99.8	6.3	94.8	33.6	89.8	49.0	84.8	62.5	79.6	76.0	69.0	104.9
99.7	7.7	94.7	33.9	89.7	49.3	84.7	62.8	79.4	76.6	68.5	106.4
99.6	9.0	94.6	34.3	89.6	49.6	84.6	63.0	79.2	77.1	68.0	107.8
99.5	10.0	94.5	34.6	89.5	49.8	84.5	63.3	79.0	77.6	67.5	109.3
99.4	11.0	94.4	34.9	89.4	50.1	84.4	63.5	78.8	78.1	67.0	110.8
99.3	11.9	94.3	35.3	89.3	50.4	84.3	63.8	78.6	78.6	66.5	112.3
99.2	12.7	94.2	35.6	89.2	50.7	84.2	64.1	78.4	79.2	66.0	113.8
99.1	13.5	94.1	36.0	89.1	51.0	84.1	64.3	78.2	79.7	65.5	115.4
99.0	14.2	94.0	36.3	89.0	51.2	84.0	64.6	78.0	80.0	65.0	116.9
98.9	14.9	93.9	36.6	88.9	51.5	83.9	64.9	77.8	80.7	64.5	118.5
98.8	15.6	93.8	37.0	88.8	51.8	83.8	65.1	77.6	81.3	64.0	120.0
98.7	16.3	93.7	37.3	88.7	52.1	83.7	65.4	77.4	81.8	63.5	121.7
98.6	16.9	93.6	37.6	88.6	52.3	83.6	65.6	77.2	82.3	63.0	123.3
98.5	17.5	93.5	37.9	88.5	52.6	83.5	65.9	77.0	82.9	62.5	124.9
98.4	18.1	93.4	38.2	88.4	52.9	83.4	66.2	76.8	83.4	62.0	126.6
98.3	18.7	93.3	38.6	88.3	53.2	83.3	66.4	76.6	83.9	61.5	128.2
98.2	19.2	93.2	38.9	88.2	53.4	83.2	66.7	76.4	84.5	61.0	129.9
98.1	19.8	93.1	39.2	88.1	53.7	83.1	66.9	76.2	85.0	60.5	131.6
98.0	20.3	93.0	39.5	88.0	54.0	83.0	67.2	76.0	85.5	60.0	133.3
97.9	20.8	92.9	39.8	87.9	54.3	82.9	67.4	75.8	86.0	59.5	135.1
97.8	21.3	92.8	40.1	87.8	54.5	82.8	67.7	75.6	86.6	59.0	136.9
97.7	21.8	92.7	40.5	87.7	54.8	82.7	68.0	75.4	87.1	58.5	138.6
97.6	22.3	92.6	40.8	87.6	55.0	82.6	68.2	75.2	87.6	58.0	140.4
97.5	22.8	92.5	41.1	87.5	55.3	82.5	68.5	75.0	88.2	57.5	142.3
97.4	23.2	92.4	41.4	87.4	55.6	82.4	68.8	74.8	88.7	57.0	144.1
97.3	23.7	92.3	41.7	87.3	55.9	82.3	69.0	74.6	89.3	56.5	146.0
97.2	24.2	92.2	42.0	87.2	56.1	82.2	69.3	74.4	89.8	56.0	147.9
97.1	24.6	92.1	42.3	87.1	56.4	82.1	69.5	74.2	90.4	55.5	149.8
97.0	25.1	92.0	42.6	87.0	56.7	82.0	69.8	74.0	90.9	55.0	151.8
96.9	25.5	91.9	42.9	86.9	56.9	81.9	70.1	73.8	91.4	54.5	153.8
96.8	25.9	91.8	43.2	86.8	57.2	81.8	70.3	73.6	92.0	54.0	155.5
96.7	26.4	91.7	43.5	86.7	57.5	81.7	70.6	73.4	92.5	53.5	157.9
96.6	26.8	91.6	43.8	86.6	57.7	81.6	70.8	73.2	93.1	53.0	159.9
96.5	27.2	91.5	44.1	86.5	58.0	81.5	71.1	73.0	93.6	52.5	162.1
96.4	27.6	91.4	44.3	86.4	58.2	81.4	71.4	72.8	94.2	52.0	164.3
96.3	28.0	91.3	44.7	86.3	58.4	81.3	71.6	72.6	94.7	51.5	166.4
96.2	28.4	91.2	45.0	86.2	58.8	81.2	71.9	72.4	95.3	51.0	168.6
96.1	28.8	91.1	45.3	86.1	59.1	81.1	72.1	72.2	95.8	50.5	170.9
96.0	29.2	91.0	45.6	86.0	59.3	81.0	72.4	72.0	96.4	50.0	173.2
95.9	29.6	90.9	45.8	85.9	59.6	80.9	72.7	71.8	97.0	49.5	175.6
95.8	29.9	90.8	46.1	85.8	59.9	80.8	72.9	71.6	97.5	49.0	177.9
95.7	30.3	90.7	46.4	85.7	60.1	80.7	73.2	71.4	98.1	48.5	180.3
95.6	30.7	90.6	46.7	85.6	60.4	80.6	73.4	71.2	98.6	48.0	182.8
95.5	31.1	90.5 (1)	47.0*	85.5	60.7	80.5	73.7	71.0 (2)	99.2†	47.5	185.3
95.4	31.4	90.4	47.3	85.4	60.9	80.4	74.0	70.8	99.7	47.0	187.8
95.3	31.8	90.3	47.6	85.3	61.2	80.3	74.3	70.6	100.3	46.5	190.4
95.2	32.1	90.2	47.9	85.2	61.4	80.2	74.5	70.4	100.9	46.0	193.1
95.1	32.5	90.1	48.2	85.1	61.7	80.1	74.8	70.2	101.4	45.5	195.7
										45.0	198.4

EXAMPLES: * Load is 100 kw and 47 kvar
What is power factor?
Kvar is 47% of kw
At (1), read 90.5% power factor

† Load is 100 kw at 71% power factor
What is kvar?
At (2), 71% pf, kvar is 99.2% of kw
Then 99.2% of 100 kw is 99.2 kvar

more KVAR on the pole

the smallest, lightest capacitor on the market

To meet the demands of operators and linemen General Electric especially designed and introduced the 25-kvar capacitor. Every ounce is a working ounce—there is no *waste* space.

Its light weight and small size make it easier to handle and install—permit more units to be installed without increasing pole weight—allow greater clearances for safety factors in crowded locations.

It takes know-how to make good things come in small packages. That's why the 25-kvar capacitor is so small, per kilovar. There's 50 years of know-how behind it.

Outstanding in service, performance and user satisfaction, it saves you money in space and weight. Buy the best. Specify G.E.'s 25-kvar capacitor. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

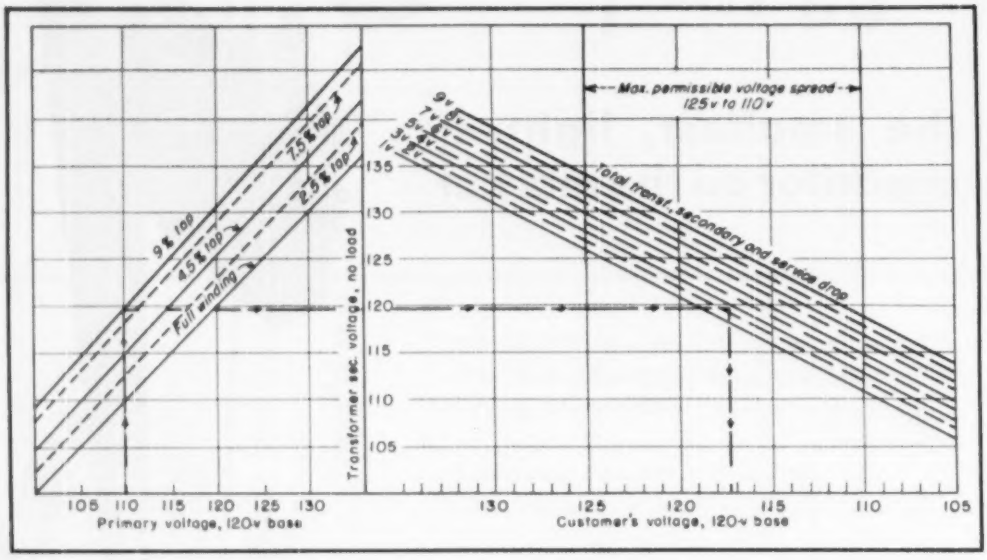
GENERAL ELECTRIC

407-29

User's Voltage in Terms of Transformer And Secondary Conditions

Chart gives customer's voltage, on 120-v base, in relation to primary voltage transformer taps and transformer secondary and service drops

N. H. ERLANDSON, Distribution Design Engineer
Carolina Power & Light Co, Raleigh, N. C.



EXAMPLE

Given: Primary voltage, 110 v
Transformer on 9% tap
Transformer secondary and service drop 2.5 v

Find: Customer's voltage

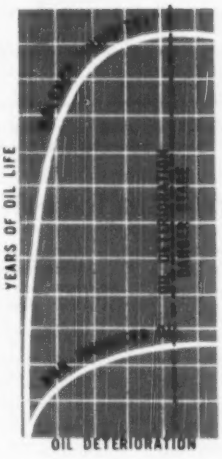
Solution: Enter chart at primary voltage 110; move vertically upward to 9% tap, then horizontally right to 2.5-v drop, and vertically downward.

Read: Customer's voltage, 117.2 v

I'M NOW FILLED WITH "*INHIBITOL*"... THE NEW INHIBITED MOLONEY TRANSFORMER OIL...WITH 4½ TIMES LONGER LIFE...

...*AT NO EXTRA COST!*

You can really hang 'em and forget 'em now! We recognize that distribution transformers are subject to great abuse. It is often economical to operate transformers at great overloads during peak load periods and impractical to include them in a regular maintenance program. Moloney HiperCore Distribution Transformers now are filled with *"Inhibitol"* which has a maintenance-free life as much as 4½ times greater than non-inhibited transformer oil.



"Inhibitol", the new transformer oil that is now standard in all Moloney Distribution Transformers at *no extra cost*, greatly increases the normal maintenance-free life of transformers. The inhibitor greatly retards (1) oxidation, (2) formation of acid which attacks insulation, and (3) formation of sludge which slows heat transfer. Chart shows result of comparative test of non-inhibited transformer oil and Moloney *"Inhibitol"*.

MOLONEY ELECTRIC COMPANY

Sales Offices in all Principal Cities

FACTORIES AT ST. LOUIS 20, MO., AND TORONTO, ONTARIO, CANADA

Telescoping Pole

(Continued from page 128)

bly. A crossarm is attached to the top of the telescoping pole for these operations and may be rotated to raise it between existing conductors.

The telescoping pole is made of three sections of steel pipe. The lower section (4 in. OD) is 17 ft long and has fittings for attaching the truck-derrick line to hold the pole firmly in a vertical position. The base of this section may be set on the ground or raised to truck-body level and held there firmly. Another pipe section (3½ in. OD) is 17 ft 7.5 in. long. It can be fitted inside the base section and has a cable roller fitting at the top for raising a third telescoping 10 1/3-ft pipe section by steel cable to any desired elevation.

A round or rectangular working platform may be attached to the top section, or a treated wood extension with revolving crossarm may be added. Fittings are provided for attachment of guys where needed.

A central pipe, extending above the working platform about waist high, is equipped with a substantial metal ring to which safety belts or toolhoist lines may be attached.

Truck derrick and winch are used to hoist the telescoping pole into its vertical working position and to elevate the crossarm or platform loaded with workmen. Steel pole steps on one leg of the derrick and on the platform braces afford access to the platform in its lowest position. When not in use the telescoping pole sections and attachments can be laid on the truck body. This avoids reloading from the ground for transporting from one point to another.

Telescoping pole and attachments were constructed according to our specifications and under our direction. Approximately 80 man-hours (one mechanic and one welder) were required to construct this telescoping pole and attachments.

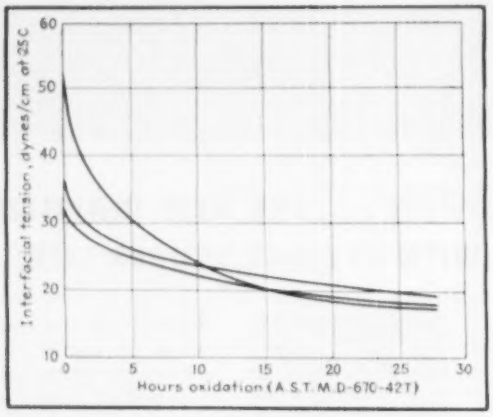


FIG 1—OXIDATION RESISTANCE of used insulating oil reclaimed to various interfacial tension values by fullers earth

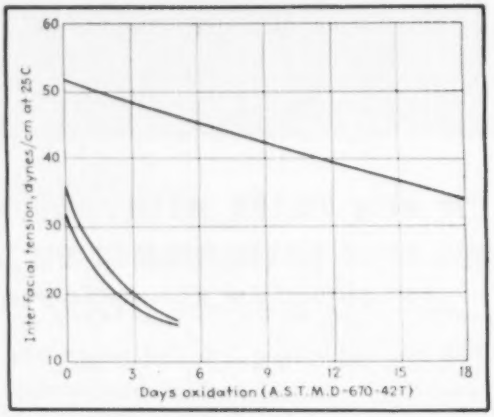


FIG 2—OXIDATION RESISTANCE of used insulating oil reclaimed to various IFT values and inhibited with 0.3% DBPC

Test Program Investigates DBPC Oil Inhibitor

R. G. CALL
Mechanical Engineer Division
American Gas & Electric Service Corp
New York, N. Y.

Experimental study of di-tertiary-butyl-para-cresol (DBPC) has shown it to be superior to the phenylalpha-naphthylamine previously used on the American Gas & Electric system as oxidation inhibitor for transformer oil. DBPC is not affected by ultra-violet light, it is insoluble in water and it is not removed from the oil by fuller's earth. Furthermore the oxidation products are soluble in the oil. The purity of the technical grade material is satisfactory.

Oxidation tests on reclaimed oil inhibited with technical and purified DBPC indicate that the purified material is somewhat better, but the difference cannot justify the additional cost, which is approximately 50% greater.

A number of field tests are now under way throughout the AG&E system on reclaimed inhibited oils in transformers and oil circuit breakers. For transformer oils, 0.3% inhibitor by weight, and for oil circuit breaker oils, 0.05% by weight have been specified. The program set up for testing these inhibited oils will be at 6-month intervals for 18 months and then yearly.

Frequent preliminary sampling is necessary in order that the degree of extraction from the insulation may be known. Caution is being exercised in inhibiting new oils in new transformers, pending further work by this laboratory and laboratories of the equipment manufacturers. At present our plans are to inhibit the oil in two new transformers and place them under careful observation.

Work on the use of inhibitor for oils that have been reclaimed to various interfacial tension values is now in progress and some preliminary data are shown in Fig 1 and 2. In Fig 1 it will be noted that the oil which has been reclaimed above 50 dynes has much less resistance to oxidation than the two oils which were reclaimed to interfacial tension values between 32 and 36 dynes. The situation is reversed upon addition of the inhibitor

(Continued on page 138)

Check these exclusive features of L&N Voltage and Power Factor Recorders

Multiple-Point A-C Voltage Recorder With Suppressed Range, Extra Readability

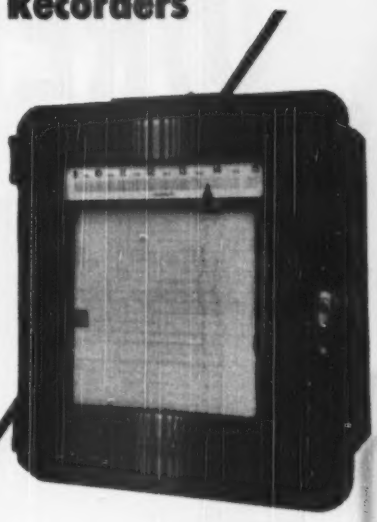
Wherever highly legible and accurate records of a-c voltage are required—for feeder or bus regulation or for control of reactive power flow—Micromax and Speedomax instruments offer exceptional features:

1. Suppressed-zero range discards the part of the voltage scale that the operator doesn't need to watch, and spreads the few volts or kilovolts in which he is interested across the instrument's entire chart width of 9⅞ inches. Thus for a nominal 115-volt circuit, you can choose a range of 90 to 130 volts, easily readable to ½ volt.

2. A single Micromax or Speedomax instrument records voltages on as many as sixteen separate feeders—reduces instrument cost because one recorder does the work of several. Related voltages can be readily compared on the same chart.

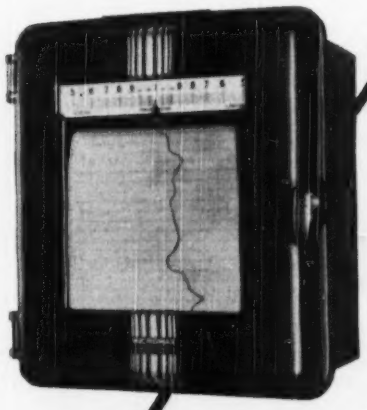
3. Recorder can be installed remote from the metering point, because the instrument is a d-c potentiometer and draws no current from the thermal converter metering element.

Standard ranges are supplied for the usual bus, transmission and distribution voltages.



A-C voltage recorder (Speedomax 6-point model is shown above) has square-law scale which adds to readability at upper portion of range.

Standard range for strip-chart Micromax Power Factor Recorder is 0.5 lead to 0.5 lag. Note legibility of record on 9⅞ inch wide chart.



Power Factor Totalized on 3-Phase Feeders

Industrial power consumers obtain accurate records of power factor on 3-phase circuits, by means of Micromax Recorders . . . with these outstanding advantages:

1. A single instrument can show the power factor of total load on a multiplicity of feeders. Where a number of power lines supply a plant's needs, the Micromax instrument measures and records power factor of plant load for all purchased power.

2. The recorder can be located hundreds of feet from the metering point . . . wherever its information can be utilized most effectively.

Both of these characteristics come from the unique measuring method which is employed. The metering device, a standard two-element thermal converter, is connected in the three-phase circuit being measured. The Micromax Recorder is a d-c null-balance potentiometer calibrated directly in per cent power factor. To totalize several feeders, the thermal converter outputs simply are connected in series and wired to the recorder.

For further information write to Leeds & Northrup Co., 4938 Stenton Avenue, Philadelphia 44, Pa.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad ND4-51(1)

DIRECT CURRENT

USERS—

BUFFALO ELECTRO-CHEMICAL ORDERS THIRD AND FOURTH I-T-E MECHANICAL RECTIFIERS

Here in a nutshell is the power conversion news of the year! After pioneering the first mechanical rectifier installation in the U.S.A., the management of Buffalo Electro-Chemical Company, Inc., Buffalo, N.Y., again has chosen the I-T-E Mechanical Rectifier to furnish power for a modernization program.

Deciding factors in Buffalo's decision were the mechanical rectifier's high inherent efficiency, small space requirement, low maintenance cost, and ease of operation.

The two original rectifier units, both rated at 3500 amperes, 260 volts d-c, have given 96.6% efficiency in their installation [illegible]

HERE'S NEWS FOR *You!*

MORE INDUSTRIAL ORDERS FOR MECHANICAL RECTIFIERS

Further power conversion news has been made by the following companies, who have placed orders for their first I-T-E Mechanical Rectifiers.

GENERAL MOTORS CORP.
Janesville, Wisc.

•

HERCULES POWDER CO.
Hopewell, Va.

•

SUPERIOR GAS & EQUIPMENT CO.
Philippine Islands

•

U. S. METALS REFINING CO.
Cartaret, N. J.

•

MARATHON PAPER MILLS OF CANADA, LTD.
Marathon, Ontario, Canada

•

IMPERIAL CHEMICAL INDUSTRIES, LTD.
Cheshire, Runcorn, England

•

PENNSYLVANIA SALT MFG. CO.
Wyandotte, Mich.

•

FIELDS POINT MANUFACTURING CORP.
Providence, R. I.

These companies join the growing list of users of the mechanical rectifier. The many adv[illegible]

Get the complete story: You'll find complete technical information, including a detailed presentation of operating principles, in I-T-E Bulletin 4B10. Send for it today. The I-T-E representative in your locality will be glad to advise you on adapting the I-T-E Mechanical Rectifier to your specific needs. Consult him without obligation.

FOR APPLICATIONS UP TO 10,000 AMPERES PER UNIT IN THE 30 TO 600 VOLT RANGE

I-T-E MECHANICAL RECTIFIERS

I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pa.

Power Rectifying Engineers: Sidney Mechanical Engineering Co., Greensburg, Pa.

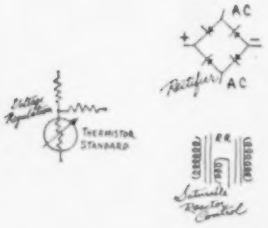
Canadian Mfg. & Sales: Canadian Power Rectifiers, Ltd., Toronto • Export Sales: Philips Export Corp., New York

MECHANICAL RECTIFIERS • SWITCHGEAR • CIRCUIT BREAKERS • METAL-CLAD SWITCHGEARS • CIRCUIT BREAKERS • RECTIFIERS • SPECIAL PRODUCTS

HIGHER EFFICIENCY

OVER WIDE LOAD RANGE WITH PECO BATTERY CHARGERS

- New control circuits
- Reduced stand-by power consumption
- Accurately controlled



PECo Battery Chargers establish a new standard of efficiency in charging equipment . . . Incorporating the latest developments in selenium rectifier stacks, transformers and saturable reactors, power loss has been cut to a minimum. Convection cooled, there are no fans, blowers or other moving parts; thus maintenance is minimized, and stand-by power loss reduced to practically zero. Important, too, is the fact that this new higher efficiency has been achieved with no sacrifice of control accuracy . . . Look into a PECo Battery Charger; you will find an outstanding quality in both workmanship and material; you will find that every component is conservatively rated to give an extra guarantee of safety, efficiency and durability . . . Write today for complete information.

POWER EQUIPMENT *Company*

Specialists in Controlled Rectifiers Since 1935

85 ANTOINETTE STREET / DETROIT 2, MICHIGAN

Oil Inhibitor

(Continued from page 134)

as shown in Fig 2. The oil reclaimed to above 50 dynes shows no indication of breaking at the end of 18 days of oxidation, while the other two oils show failure within 3 to 4 days.

Studies by Koppers Co and Doble Engineering Co have shown that the lives of reclaimed oils of low interfacial tension value may be considerably increased above those shown in Fig 2 by increasing the inhibitor content to as high as 1%. Again, economics should govern the practice.

It is not the intent to discourage the inhibiting of oils of low interfacial tension value, because used oils reclaimed in the field by means of portable filters of the fuller's earth type will usually have IFT values between 30 and 40 dynes. The inhibiting of such oils is in order. As extraction from the insulation occurs, and the extraction products concentrate in the oil, they may be removed by reclaiming without loss of the inhibitor.

GRIT SPREADER provides traction for vehicles on icy streets. The device is simple to use and will not clog

Traction on Icy Streets Provided by Grit Spreader

Positive traction is assured, even on ice, by a new grit spreader perfected by C. L. Turner, automotive supervisor, Wisconsin Power and Light Co. Spreader is said to function perfectly, without clogging, in any weather.

The device consists of a metal tube about 2 ft long and 2 in. in diameter

(Continued on page 143)

HI-TENSION NEWS *Junior*

They're Replacing the O-B Insulation on this Line

...and we're still proud of it!

Originally built in 1912 with some of the earliest insulators O-B made, this line has recently been modernized and the O-B veterans retired. But for more than a generation these insulators served well, and their younger improved successors likewise bear the "O-B" trademark.

In our illustration, the center phase on the left is still supported on O-B units nearly 40 years old. With the advanced technical improvements in the new insulators now on the line, the next 40 years will be easier yet to roll up.

For insulation that you can install and then forget--except when you want more --specify O-B.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

OB

HI-TENSION NEWS *Junior*

A REAL IMPROVEMENT ON THE POST INSULATOR

Only in the O-B line post is the Clamptop added to the other features that distinguish this insulator. This eliminates all tie wires and reinforces the inherent radio-quietness of the insulator design. Likewise, the Clamptop has the outstanding advantage of being almost as easy to work hot as cold. A simple hot stick wrench is all that you need to accomplish a "tie" that can't be duplicated for strength by the best hand serve--in a fraction of the time--with no special hazard to the hot crew.

For easier installation, easier hot handling, and improved radio performance, specify O-B Clamptops for your next line post construction.

Don't Cut Your High Voltage Conductors!

Slack jumpers at strain points in a transmission line are sometimes cut and connected with parallel groove clamps. These connections, under high current and prolonged atmospheric exposure, are definite sources of serious operating trouble, as the reports of many power companies adequately testify.

Jumpers don't *need* to be cut. Conductors can be strung through strain points with ease. All it takes is a strain clamp that attaches *around* the cable--the O-B Hi-Lite clamp. Not only does this clamp develop full working strength of the cable, but the soundness of its attachment may be fully inspected for the life of the line. No special tools, equipment, or skills are needed for installation. Material and labor costs are 'way down, holding power is high, and jumper splices are eliminated.

It's well worth your while to investigate O-B Hi-Lite strain clamps, made in either ferrous metal or non-magnetic aluminum alloy. You won't have to cut your high voltage conductors.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

B

HI-TENSION NEWS *Junior*

This new Pennsylvania transformer will soon be in service on an important Northwest power system. Characteristics of this large unit are: "Rating, 30,000 kva with provisions for future forced cooling to raise this to 40,000 kva. Three-phase, 60-cycle, 55-degree (C) rise. Outdoor Auto Type. High voltage, 110 kv, Y. Low voltage, 66 kv, Y. Tertiary voltage, 11.5 kv. Nitrogen gas-equipped with high and low pressure alarm contacts. Tank rein-forced for 15 pounds pressure and full vacuum. Featured are Pennsylvania Transformer Company's straight line tap changer with silver-to-silver contacts, and Uni-Row detachable radiators; also special base construction which permits the transformer to be rolled or skidded in any direction, and provides for jacking without interference from radiators. Both high and low sides are equipped with . . . . "

O-B BUSHINGS

ONE OF THE FINEST COMPONENTS OF ANY TRANSFORMER

Ohio Brass

MANSFIELD, OHIO, U.S.A.

3069-H

Grit Spreader

(Continued from page 138)

with a small hole at one end. There is a stationary rubber cap at the bottom of the tube and a movable rubber cap, with a hole in it, at the top end. When hole in cap is aligned with hole in the tube, spreader is ready to operate. Tube may be closed by a slight turn of the cap.

Grit used is a commercial product, is composed of razor-sharp pieces and is particularly effective on slippery surfaces. It will not pick up moisture which would result in clogging the tube opening, nor will it freeze in cold weather.

•

Infrared Lamps Used To Dry Flyash

INFRARED LAMPS are used to dry flyash in the laboratory of Cliffside Station of Duke Power Co. This new method replaced the old bunsen burner method which caused the ash to sputter and jump out of the pan. Lamps are installed in a laboratory type hood having an exhaust fan. Each lamp is controlled individually by a tumbler switch

•

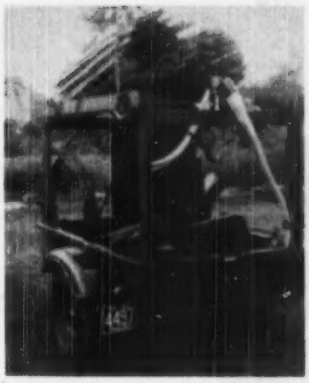
Multi-Purpose Trailer For Service Restoration

S. B. SAWYER

Electrical Engineer
Fitchburg Gas & Electric Light Co
Fitchburg, Mass.

A low-cost trailer equipped with a 50-kva transformer for rapid restoration of service is employed by a New Hampshire utility in case of trouble on larger distribution transformers. The transformer has insulated primary and secondary leads, cut-out box and other accessories.

To safeguard the transformer in



TRAILER carries a 50-kva transformer and accessories. "Snow" fencing is used as safety measure when unit is energized

operation, a section of "snow" fencing is used. It is carried on the upper part of the trailer attached securely to a frame. Line material is carried on the lower portion of the trailer, leaving the regular truck bodies of the company fleet free for easier access to tools and equipment.

This type of trailer has been found useful for serving carnivals and other short-time loads within the capacity of the transformer. A meter switch is included for this purpose in one of the company units.

Rain Spout Storage Rack For Disconnect Poles

RAIN SPOUTS are used effectively to keep 20-ft long disconnect poles dry and protect them from the weather, at the Gastonia Junction substation of Duke Power Co, Gastonia, N. C. Spouts with one end closed are mounted on steel brackets on the substation building. Pieces of discarded automobile tire casings are used inside the spouts to protect the wooden poles against scratching. W. P. Glover, chief operator at the substation, who originated the idea, demonstrates how spouts are used

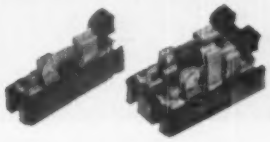
STATES TESTING EQUIPMENT

TEST BLOCKS
With many exclusive features—

Solid Base.

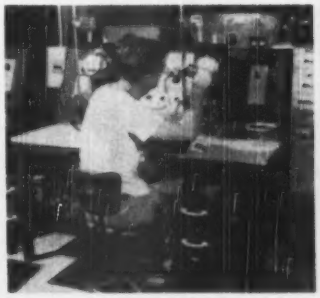
Among the many features built into STATES' Blocks may be listed:—

1. No live parts extend beyond base, an important safety feature.
2. Nickel plated, non-corrosive finish.
3. Angle bent studs permit quickly changing from front to back connection, and many other features.



Potential Current Unit Base Blocks.

Photo Electric
Controlled
Watthour Meter
TEST TABLE



Provides:—

LOW COST TESTING
IMPROVED ACCURACY
SAVING of TESTING TIME

The inherent accuracy of this equipment makes small test runs unnecessary.

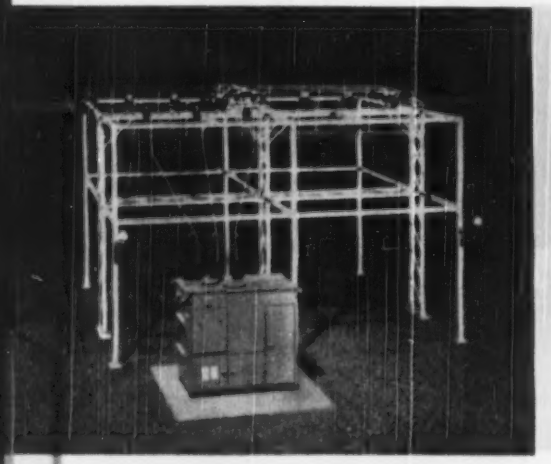
Operators do not need to watch meters during the running period. Light beam and relay count revolutions of meter under test, and automatically starts and stops the testing.

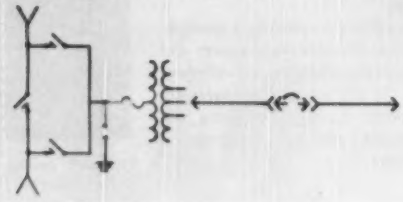
TEAR OFF AND MAIL TODAY to

THE STATES COMPANY
3 NEW PARK AVE., HARTFORD 6, CONN.
Please send latest information on
Test Blocks ☐ Test Tables ☐
Name ..... Title .....
Firm .....
City ..... State .....

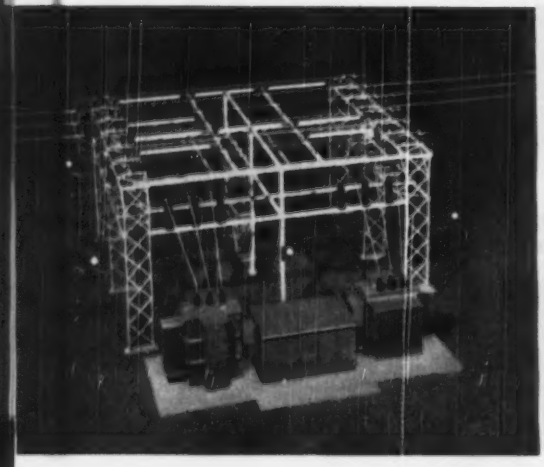
YOU CAN BE **SURE**.. IF IT'S

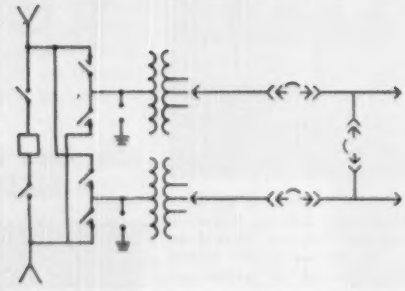
Westinghouse



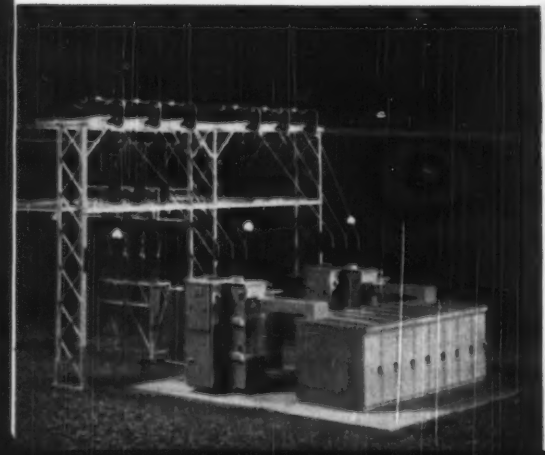


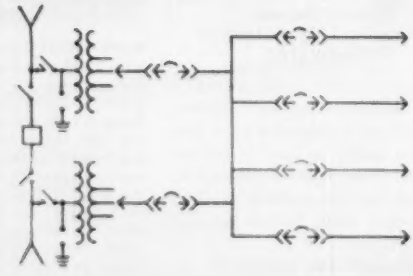
Single-feeder CSP Substation—Loop or tie subtransmission circuit—Manual sectionalization, manual selection.





Two-feeder Duplex Substation—Loop or tie subtransmission circuit—Automatic sectionalization, manual selection.

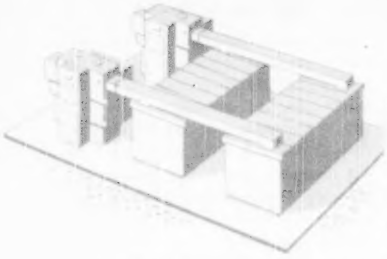




Three-or-more-feeder Spot Network Substation—Loop or tie subtransmission circuit—Automatic sectionalization.

SUBSTATIONS with A FUTURE

...lower power distribution costs



The system planning you do today must allow for future load growth, and load shifts . . . if lower power distribution costs are to be realized. The substations you choose *now* will help make this possible . . . *if they are designed with a future!*

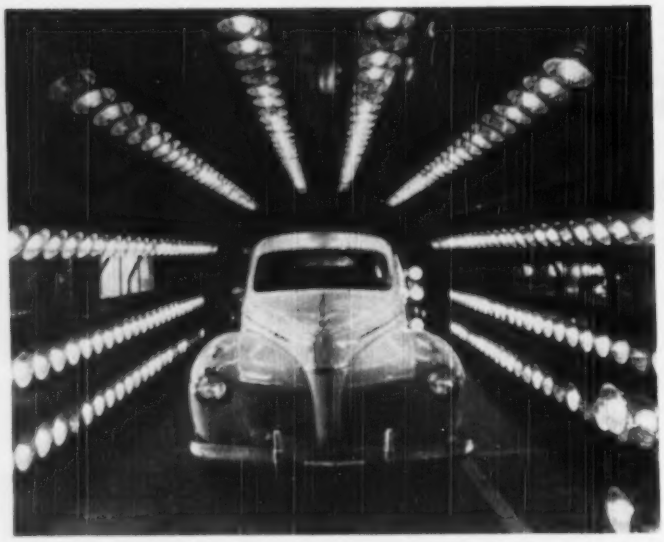
The Westinghouse Coordinated Substations, shown here, have this "allowance for the future". They not only meet today's load demands, but provide the flexibility vital for future changes in load requirements. *They Become One of Your First Steps in Lowering Power Distribution Costs.* Their design is a result of today's modern power distribution trends. These trends are reducing distribution costs by simplifying systems and standardizing equipment. Simplifying subtransmission circuits reduces the amount of equipment used. Standardizing equipment results in production savings that are passed on to you.

Due to the compactness of these Substations, "blocks of power" can be easily and economically added or removed to take care of increased load requirements, load shifts or relocations. You realize maximum salvage value.

For more complete information, get your copy of the Coordinated Substation Book, B-4061. Ask your Westinghouse representative for it, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60728-A

Westinghouse

COORDINATED SUBSTATIONS



INFRARED BAKED ENAMEL paint jobs on automobiles are more beautiful and last longer. This 14x30-ft dust proof oven has 320–250-w infrared lamps

POWER SALES IN INDUSTRY

Cut Costs, Build Business With Infrared Oven

B. M. DAVIS
Commercial & Industrial Sales Mgr

W. W. HUNTLEY
Commercial Dept
Mississippi Power & Light Co
Jackson, Miss.

The infrared baking oven installed at Bagby Hall Motors, Inc, Jackson, Miss., has not only cut baking time to 20 min (for a hard finish) on enamel paint jobs, but made them more beautiful and longer lasting. Within 60 days after installation, painting volume jumped 98% and during the first six months of operation more than 200 cars had been painted. One customer drove nearly 900 miles for a paint job after hearing that these facilities were in operation. Most customers come from a 100-mile radius.

The 14x30-ft dustproof baking oven has 320 250-w infrared lamps arranged in 10 rows—forming an arc over the car. Additional standing units apply heat to the front and rear of car. Oven is constructed of 16 gauge steel. Only 15 to 30 min is required—depending on the color. Baking temperature is 175 to 190 deg. Light colors require more time than dark tones—usually 30 min.

Air is changed three times a minute in the spray room by an exhaust fan. A partition of slatted steel baffle plates at the rear of the room prevents the air from blowing in as a solid mass. The air is filtered through special spun-glass filters at the bottom of doors at the front and rear of the oven. Twelve flush ceiling lights provide ample light intensity.

Old paint strainers are used for masking headlights. They are covered and taped to the headlights—saving considerable work.

Before spraying the car, a baking sealer is applied to prevent the old paint from bleeding through onto the new finish. All paints are mixed in an electric mixing machine having a capacity of one-half pint to one gallon.

One Day for the Job

The entire painting process normally requires about a day. A flat rate of $59.50 is charged for solid paint jobs on passenger cars and $79.50 for two-tones. Prices on trucks vary slightly. A solid paint job costs the company about $39 and a two-tone job about $11 more. That leaves a narrow margin of profit but it was decided to operate the shop on a volume rather than a long-profit basis.

Ten hand-written post cards are mailed a day to motor-vehicle registrants in the two counties. A total mailing of about 2,000 is planned.

Another idea that has been producing good results consists of watching for cars and trucks that need paint jobs badly. When an employee finds one he jots down its license number and the owner's name is checked through that source and he is mailed a personally-written card or letter.

All eleven employees, including office workers, receive $4 for each paint job they sell. This commission plan has produced about 75% of the painting volume.

Purchase and installation of the spraying room and oven equipment cost approximately $9,000 but Bagby Hall officials decided almost immediately that the sum had been spent wisely.

The paint sprayer receives 40% of the price of each job. He pays his two helpers out of these commissions. These men are employed by him and are not listed on the Bagby Hall payroll.

In order to keep the paint sprayer and his helpers occupied, the firm runs cars from its used-car lot through the paint shop when a lull develops.

When you think of Electric Heat...

think of Hoskins Chromel*

One quick glance at your industrial heating load will tell you that electric furnaces account for a good and growing part of your total power sales. They represent a highly promotable load potential, too. Because they're safer, cleaner, easier to work with than fuel-fired equipment. They improve working conditions, assure greater productivity, produce better results. They provide more uniform distribution of heat, permit closer control of temperatures, offer greater flexibility of operation. And in addition, too, they give unusually dependable performance over long, hard periods of use thanks to the extreme durability of HOSKINS CHROMEL heating element alloy.

CHROMEL, you know, is the *original* nickel-chromium resistance alloy that *first* made electrical heating practical. It's highly resistant to oxidation because, in use, it forms a thin, dense oxide "skin" which acts as tight, protective armor against further deterioration. It possesses close-to-constant "hot" resistance between 700° and 2000°F., delivers full-rated power throughout its long and useful life. And, backed by over 40 years specialized research, manufacturing and application experience, CHROMEL has been used consistently and with confidence by nearly every manufacturer of industrial, commercial and household electrical heating devices.

So where you're called in on an electrical heating application, you'll do well to recommend the use of HOSKINS CHROMEL heating element alloy. It's your best assurance of giving your customers the continuity of service they want.

Our Catalog M-1 contains useful technical information and helpful application data . . . want a copy?

HOSKINS MANUFACTURING COMPANY

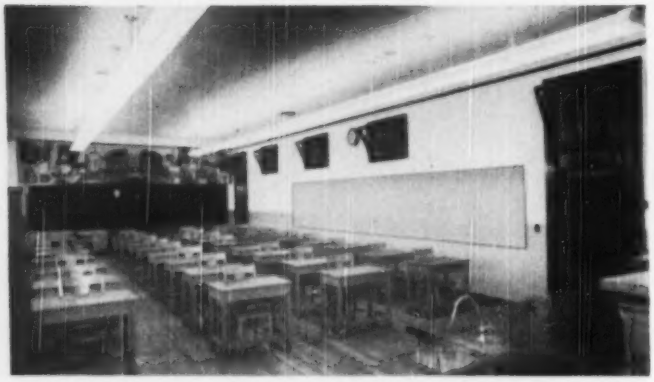
4445 LAWTON AVE. • DETROIT 8, MICHIGAN

NEW YORK • CLEVELAND • CHICAGO

West Coast Representatives in Seattle, San Francisco, Los Angeles
In Canada: Walker Metal Products, Ltd., Walkerville, Ontario

**the original nickel-chromium resistance alloy that first made electrical heating practical*

Demonstration Rooms Help Swing School Relighting



FLUORESCENT INSTALLATION in East Nashville High School maintains an average 35 ft-c, instead of 30 ft-c, with two rows of fixtures. The extra 5 ft-c was gained by moving the fixtures in from the windows two additional feet for maximum benefits from daylight. Light green blackboards and rooms repainted in lighter colors helped

Renovation of the lighting in more than 800 rooms of 28 Nashville, Tenn., schools has been completed at a cost averaging $224 per room. The new fluorescent fixtures brought illumination up to an initial 35 ft-c from the original 8 ft-c. To make the most of the relighting job, blackboards were refinished with light green paint, and walls and ceilings were repainted in lighter colors which reflect maximum light back into the room.

Demonstration installations were made in the Hume-Fogg Technical and Vocational High School. Since the business offices of the city schools are located here, the relighting proved very helpful in getting approval for the entire program. This school was particularly suited to experimental testing and checking since the wire capacity was sufficient for a complete lighting job with fluorescent. All rooms had two circuits and No. 12 wire was used for branch circuits.

School authorities agreed to install and pay for sample installations in as many classrooms as the jobbers wished to furnish. A dozen or more classrooms were relighted with two-lamp (3,500 K), 40-w louver-shielded fixtures directing approximately 60% of the light downward and 40% upward. From these rooms, selections of fixtures, spacings, and ceiling height were made. The average classroom is 20 to 22 ft x 28 to 30 ft.

Planning for the program was done by E. L. Bickley, director of planning, maintenance, and plant operation for the Nashville City Board of Education. He was assisted by Sam B. LeCornu, Lighting Dept, Nashville Electric Service.

Fixture mounting height was 10 ft on a 12-ft ceiling. Spacing of continuous rows did not exceed 10 ft. Over 7,000 fixtures were installed.

When no new circuits were needed, 12 to 14 fixtures could be installed in most rooms by two men in an 8-hr day. The entire job was done by the School Board's own staff of workmen, supplemented by some shop men from Hume-Fogg's electrical department.

Authorities of the county school system—which is independent of the Nashville system—were so impressed by the results that they have instituted a similar program involving about as many school buildings as in the city.

Electric Egg Washer Does 10 Cases an Hour

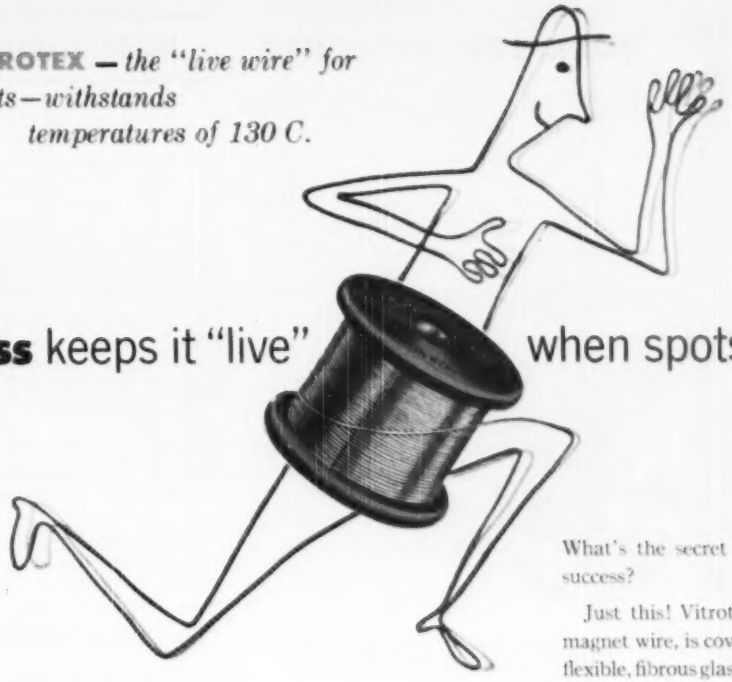
ELECTRIC EGG WASHER can clean and dry a case of eggs in 6 min, using rotating rubber rollers, stationary brushes, blood-warm water, and heated forced air

Eggs are cleaned, dried, and placed in cases at an average rate of 6 min per case with electrical equipment on a poultry farm near Salt Lake City.

The egg cleaner consists of rubber rollers which are rotated by a fractional horsepower motor, four lamps to heat the air used to dry the eggs, and a second fractional horsepower motor driving a fan to force circulation of the warm air over the eggs after they have been washed.

The small stream of water which washes the eggs as they are rotated is supplied from an electric water heater and kept at blood temperature by an automatic control which mixes it with cold water. The clean eggs are taken from the roller spray and placed over the drier in lifting trays, each holding three dozen eggs.

VITROTEX — *the "live wire" for hot spots—withstands temperatures of 130 C.*



Glass keeps it "live" when spots get **Hot**

What's the secret of its heat-resistant success?

Just this! Vitrotex*, unlike ordinary magnet wire, is covered with alkali-free, flexible, fibrous glass insulation—bonded with a special, high-temperature varnish. This protects windings against hot spots as high as 130 C. . . . provides high flexibility, excellent heat conductivity and an amazing space factor . . . plus high dielectric strength.

The smooth surface of Vitrotex successfully resists abrasion, moisture, acids, oils and corrosive vapors . . . and its tightly wound coils provide safer operation in confined areas under high heat.

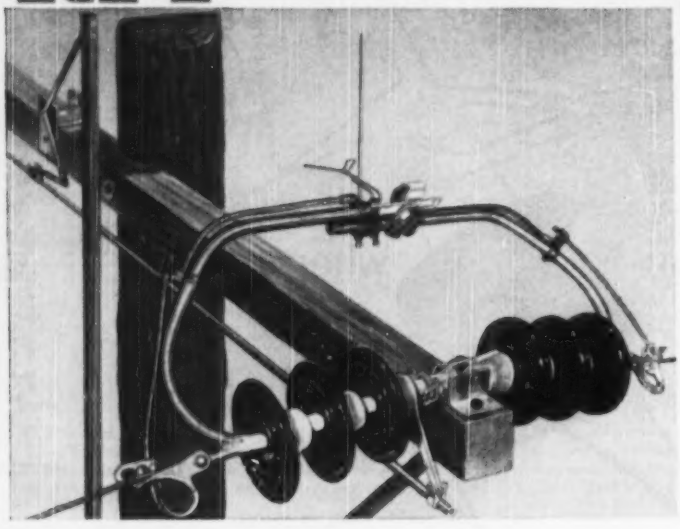
Contact your nearest Anaconda Sales Office or Distributor for information on Vitrotex and the entire line of Anaconda Magnet Wire. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York, or 20 N. Wacker Drive, Chicago 6, Illinois.

*Reg. U. S. Pat. Off.

the right wire for the job **ANACONDA®**

WIRE AND CABLE

KPF POLE TOP SWITCHES



Simple design means more switch ...for less money!

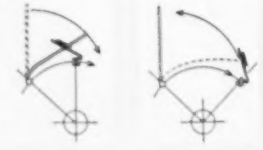
KPF Pole Top Switches cost less because they are simplest in design. They lower installation costs because they bolt on a single crossarm in minutes, require no extra insulators. KPF switches save, too, on upkeep; simple push-pull interphase rods never bind because of crossarm warpage; monel and bronze bearings never need lubrication.

KPF switches may be used in horizontal, vertical or triangular mounting. Free floating, self aligning blades and jaws maintain proper contact under all conditions of switch sag adjustment.

NEW QUICK-BREAK ATTACHMENT FOR KPF SWITCHES

The split-second breaking speed of these new KPF attachments means you can switch many circuits without using expensive circuit breakers. Attachment is available for all KPF switches rated 15 to 69 kv.

WRITE FOR DETAILS



Spring rod winds to full tension as switch opens.

Rod springs clear, breaking contact at high speed.

KPF ELECTRIC COMPANY

855 Howard Street • San Francisco 3, Calif.

INDUSTRIAL BRIEFS

Hydraulic Debarker cuts labor costs and permits year round operation at the Derby Wood Products Co, Inc, York, Ala. Debarker enables 6 men to perform work formerly requiring 64 men by old hand peeling method which could only be carried on successfully 4 to 5 months a year when sap was high. In addition, this method also removes the cambium layer—which is almost impossible to accomplish by hand method. Equipment employs one 100-hp and one 350-hp motor for booster and multistage pumps respectively.—E. A. Wilson, Manager, Industrial Power Division, Alabama Power Co, Birmingham, Ala.

Electric Strip Heaters enabled Cascade Foundry, Erie, Pa., to continue production throughout unusually cold winter when gas supply was insufficient to meet industrial demands. Installation actually paid for itself several times during this winter. 42-1,000-w, 230-v strip heaters and a simple control arrangement was quickly installed.

Electrically Heated annealing furnace provides faster, more uniform heating without warpage at Western Electric Company's Point Breeze Works, Baltimore, Md. Piece parts of telephone apparatus are processed in this automatically controlled furnace. Resistance elements operate on 400 amp at 28 v and are employed with a recirculating fan.—Electric Heating Bureau, Industrial Power Dept, The Gas & Electric Co, Baltimore, Md.

Infrared cuts paint drying time and saves valuable space at the Russell Mfg Co, Alexander City, Ala. Painted names and designs on athletic uniforms are dried in from two to five hours. Former drying time was three to five days when hung separated about the room. Considerable space is saved since sheet rock lined oven is only 6x7x20 ft. At the top on each long side are 36-250-w infrared lamps —giving a total load of 18 kw. Saving in time and valuable space far offsets operating cost of oven.—Milton H. Lucky, Industrial Power Representative, Alabama Power Co, Anniston, Ala.

Crapo GALVANIZED STEEL STRAND

Combines All Four

EVERY requisite that sound construction needs demand are combined in *Crapo* Galvanized Steel Strand—

1. High strength
2. Ruggedness
3. Long life
4. Economy

The superior tensile strength inherent in steel is utilized to fullest advantage in each size and grade of this time-proved strand. The heavy, ductile, tightly-adherent galvanized coating—applied by the famous *Crapo* process—provides dependable protection to the steel, extends the life of the strand beyond the normal period of replacement.

Specify *Crapo* Galvanized Steel Strand for guys, messenger and overhead ground wires! There is a size and grade for every practical need available for prompt shipment.

ASK YOUR JOBBER!

Consult your nearest distributor of *Crapo* Products or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE INDIANA

• Completed Trouble Free Positive Connection

GREATER DISTRIBUTION SYSTEM *Security*

WITH NEW ONE PIECE K-90 AND K-900

CONNECTORS

EASY AS A B C TO INSTALL

For

GREATER STRENGTH: — Compresses conductor sealing out high resistance oxide formations on contact areas.

GREATER EFFICIENCY:—Retains high pressure contacts during vibration and temperature changes.

GREATER DEPENDABILITY: —Surpasses Mercurous Nitrate Specification ABW 124-1*, insures against seasonal and stress corrosion cracking failures.

GREATER ECONOMY: — Lower installation cost, four sizes for connections up to 500 MCM.

GREATER FLEXIBILITY: — Taps, splices and dead ends easily completed with gloves or hot line tools.

* Identical to ASTM B-154-45 Mercurous Nitrate Specification except ABW-124-1 specifies stressed components which is a more severe test

A—Hang on Main

B—Spin Nut to Partly Close

C—Insert Tap and Tighten

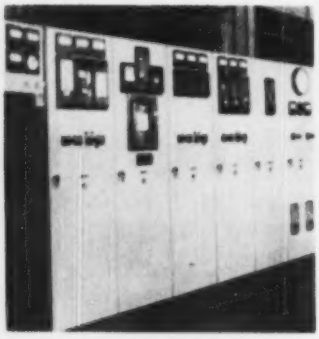
Consult one of our nearest 19 representatives or contact our main office.

Write today for Bulletin K-150 on K-90 and K-900 Distribution Connectors.

ANDERSON BRASS WORKS, Inc.
POST OFFICE DRAWER 2151
BIRMINGHAM, 1, ALABAMA

• BRONZE AND ALUMINUM POWER CONNECTORS, FITTINGS AND BUS SUPPORTS
ALUMINUM SUSPENSION AND STRAIN CLAMPS

NEW EQUIPMENT



Indoor Switchgear

More mounting space for instruments is provided in indoor air-magnetic vertical lift, metal-clad switchgear by increasing height of the instrument panel from 72 in. to 92 in. Other new features include a welded-in steel plate floor for the circuit breaker, and guide rails on each side of the breaker compartment. These rails protect the control wiring when breakers are being removed or inserted.

Secondary wiring is routed through separate metal-enclosed wiring ducts or encased in flexible conduit when passed through other compartments.

Maximum design rating of the unit's circuit breaker is 4.76 kv with interrupting ratings of 50, 150 or 250 Mva. Service voltages range between 2,300 and 4,160 v.

Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

•

Street Light Mountings

A new line of pipe brackets and mast arms for mounting street lighting fixtures is available in both aluminum and galvanized steel models. The bracket and pole plate are built in one assembly. Installation is made by a keyhole slot in the new pole plate which enables a lineman to hang the assembly on a bolt driven through the pole while tightening other bolts.

It is reported that only one man is needed to install the aluminum units because of their light weight.

General Electric Co, Lighting and Rectifier Div, Schenectady 5, N. Y.

•

Plastic-Covered Hotstick

No refinishing or drying room is required when a new plastic-covered hot stick is used, according to manufacturer. Gaff marks and small cuts can be repaired with a strip of thermoplastic material and a soldering iron with tip filed down to the copper.

The coating is produced by extruding a 1/16-in. thickness of thermoplastic material over Douglas fir of rough finish. Shrink fit caused by the extrusion process tightly grips wood fibers of the pole so that no cement is needed.

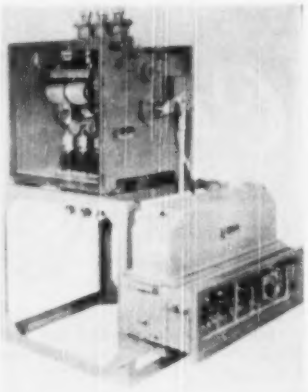
Laboratory tests have been run at air flashover voltage on the test rack at 110 kv per ft for 20 min. Cantilever strength is reported as much as 16% greater than spruce. Since tensile strength is less than oak, they are not recommended for such use with dead end equipment unless safe load rating is reduced. Abrasion resistance is claimed to be superior to varnished poles.

James R. Kearney Corp, 4236 Clayton Ave, St. Louis 10, Mo.

•

Automatic Transfer Switch

Load is transferred to the standby diesel generator with Type RAD automatic transfer oil switch if normal power source fails. When voltage of normal power source drops to 65% of normal, a control switch is actuated to start the diesel generator. A time delay relay in the control circuit allows the diesel generator to build up to full voltage before the switch operates to transfer the load. The operating mechanism will automatically return the load to the normal source and stop the diesel generator when normal source is re-energized.



Complete unit consists of a 7,500-v, 3-pole, 400-amp load-break oil switch and an automatic operating mechanism mounted on a frame of welded structural steel. Control transformers are mounted in the oil switch tank. Only three connections—load, normal feeder, and standby generator—are necessary to put the unit into operation. Additional information is in Bulletin DA50-D.

G & W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

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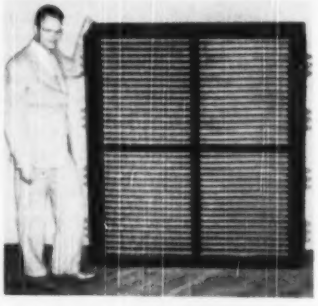
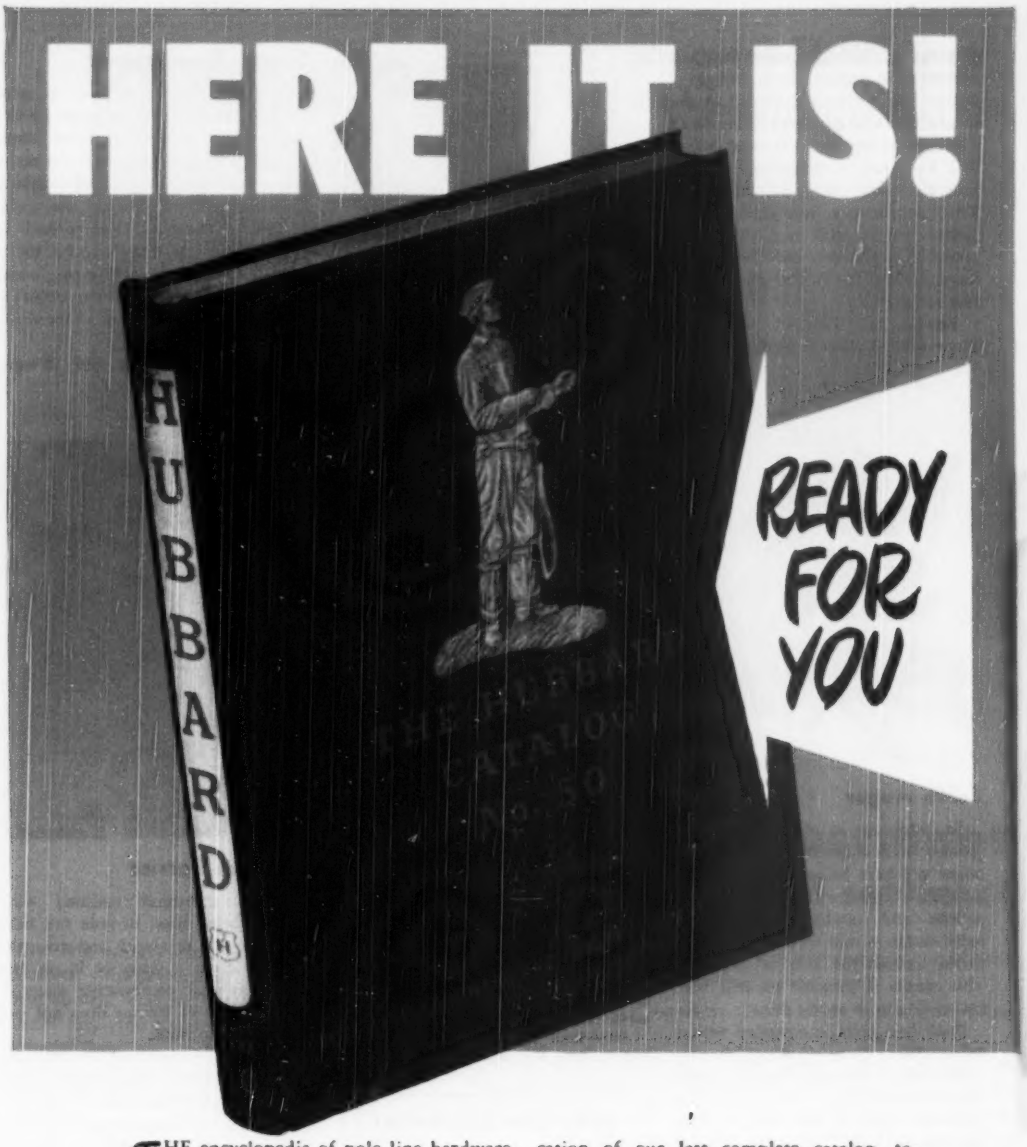


Electric Air Heater

Electric heating of large volumes of air for comfort and processing can be accomplished with Chromalox

HERE IT IS!



THE encyclopedia of pole line hardware . . . the complete, up-to-date listings, illustrations, and descriptions of the largest line of Pole Line Hardware and Accessories in the world are contained in the new HUBBARD CATALOG NO. 50.

The catalog assembles all the hundreds of new items introduced since the publication of our last complete catalog, together with all the long-time standard numbers.

If you are on our mailing list you should have already received your copy. If you have not received it, or if you haven't been on our mailing list and should be . . . just write and it will come by return mail.

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

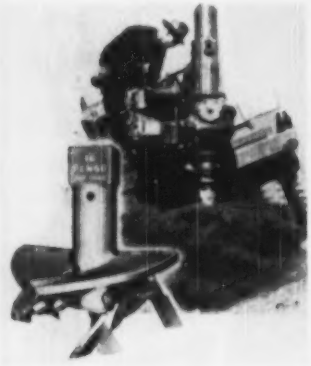
"Hang the Load on Hubbard Hardware!"

Finstrip air blast heaters. They are assembled in banks to form sections of desired size which are welded in one large frame and mounted in air ducts.

Heater in the photo is rated 440 v, 192 kw, and is composed of four separate removable quadrants of 48 kw. Each section has eight distinct circuits for stepped modulation. The complete heater can be wired for infinite control to as low as 10% of full rated capacity.

Edwin L. Wiegand Co, 7513 Thomas Blvd, Pittsburgh 8, Pa.

•



Earth Auger

In addition to drilling ordinary ground, it is claimed that the Pengo auger will bore holes in hardpan, decomposed rock, and some kinds of caliche and sandstone. The twin-helix design is said to eliminate backthrust against the side of the hole. This makes it possible to drill with less caving-in in sandy soil.

Each half helix is equipped with a shank plate, each of which is provided with replaceable cutting points of abrasion-resistant alloy steel. The augers are made in nine sizes for hole diameters to 36 in. They can be used with all popular makes of power driven earth boring machines by means of adapters.

Petersen Engineering Co, 4126 26th St, San Francisco, Cal.

•

Portable Cleaner

Portable vacuum cleaner No. 15 is a 1½-hp machine which operates one 35-ft length of vacuum cleaning hose. Over-all dimensions are such as to permit maneuverability of the cleaner in

congested areas. Size is 21½ in. wide, 40½ in. long, and 43½ in. high. The unit is designed to be fitted with Class I Group D and Class II Group G motors for hazardous locations, as well as standard open-type motors.

Heavier and larger quantities of dust are separated by centrifugal action. Complete information is contained in Bulletin A-814.

U. S. Hoffman Machinery Corp, Air Appliance Div, 105 Fourth Ave, New York 3, N. Y.

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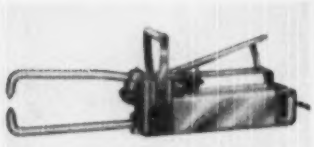

PORTABLE SPOT WELDER — Weighing only about 33 lb, Model BW self-contained welder can weld up to ¼-in. combined thickness of mild or stainless steel, or two pieces of 16-gage galvanized metal totaling ⅛-in. thick.

Greyhound A. C. Arc Welder Corp, 606 Johnson Ave, Brooklyn 6, N. Y.

MORE NEW EQUIPMENT

Just Received

Appearing Next Issue

DRY-TYPE TRANSFORMERS
Ratings of 240, 480, and 600 v for industrial lighting loads

AIR CONTACTOR
Can be used without back-up for system faults to 50,000 kva

INDUCTION MOTOR STARTER
Capacities from ¾ to 100 hp for across-the-line starting

INSULATING COMPOUND
Insulates live parts and prevents corrosion of connections

Sports Floodlamp

Physical dimensions of a new 1,800-w sports floodlight lamp are the same as the standard 1,500-w lamp. A collector grid above the filament collects the black vaporized tungsten that normally deposits on the inner surface of the bulb. This is said to cause end-of-life lumens to be about 81% of initial beam lumens, compared to 59% without the collector grid. It is rated at 117 v, and average laboratory life is 300 hr.

Westinghouse Lamp Div, Bloomfield, N. J.

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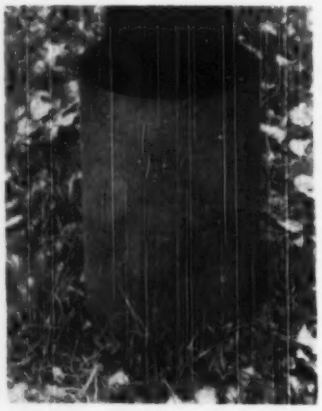


Pole Fire Barrier

Special corrosion resisting wire cloth is being used in pole fire barrier. It is said to absorb and dissipate the heat from a grass or brush fire so rapidly that combustible material on the inside of barrier does not get hot enough to burn.

The cylindrical-shaped barriers are made in various diameters to fit around different size poles. Height of the barrier, company says, should be from one-third to one-half as high as the highest grass likely to grow near the barrier. Flat panels can be obtained for protection of buildings or special areas.

F. P. Smith Wire and Iron Works, Room 237, 205 W. Wacker Drive, Chicago 6, Ill.

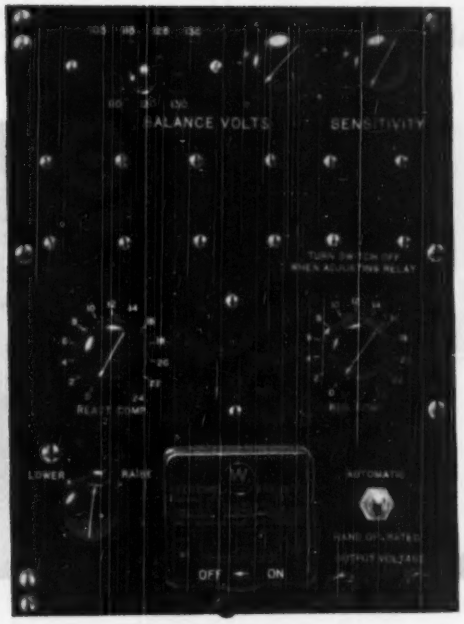
•

HF Sequence Indicator

A new polyphase sequence indicator operates on higher frequencies and over a greater frequency span than

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



The Westinghouse SU Air-Sealed, Induction Regulator.

NEW, EXCLUSIVE . . .

Complete Dial Adjustment

simplifies regulator control settings!

Now it's easier, less costly for you to maintain accurate voltage regulation . . . to build revenue. A new control unit for Westinghouse Induction Regulators lets you make adjustments by dials. Precise voltage level and band width settings become as simple as tuning your radio. And look what else has been done to make this new control . . .

Easier to operate!

- Voltage level adjustment can be obtained without the use of a voltmeter . . . without turning the line drop compensator to zero.
- Voltage band width adjustments can be made without interrupting the operating function of the control. What's more, this new control also requires . . .

Less maintenance!

- Spring-mounted elements eliminate the weaknesses of mechanical bearings. Positive engagement of contacts assures trouble-free performance.
- "Lifetime" contacts . . . have larger surfaces to assure permanent accuracy . . . unusually long life.

Write for CS 47-225, CS 47-430, DB 47-310 and DB 47-410 which contain complete facts on the entire line of Westinghouse Voltage Regulators. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70561

Westinghouse

VOLTAGE REGULATORS

FOR *ANY* SYSTEM

Invite your Board of Directors to climb a pole

It's Clean! • It's Certain!

When you climb a pole treated with PENTA Preservative you quickly see the advantages of this modern protection for poles and cross-arms.

First, you'll notice that a PENTA-protected pole is clean—not sticky or irritating to the skin. PENTA permits full-length preservative treatment with no fear of complaint from your customers or line crews.

Then, when you examine a pole and cross-arms that have been in service for a number of years, you'll see how well the PENTA treatment has done its job of protection. No signs of ground line decay, shell rot, top rot, or insect damage.

PENTAchlorophenol is a powerful, stable and uniform wood preservative —allows measured and positive protection. It penetrates deeply and will not leach out. Doesn't affect conductivity, creates no special problems.

Specify PENTA treatment for safeguarding your poles, cross-arms and other wood construction. Write us for complete facts and convincing data.

CHAPMAN CHEMICAL COMPANY
Dermon Building • Memphis 3, Tenn.

CHAPMAN

PENTA
PRESERVATIVE

Conforming to A. W. P. A. Specifications P8-49 and P9-49.

conventional indicators. The Selco indicator operates over 50 to 600 v, 25 to 400 c. At 200 v or greater, it will function up to 2,000 c. The indicator shows phase sequence by direction of disk rotation rather than by lamps. Only one connection of the conductors to the polyphase line is needed.

Instrument movement is a 4-in. enameled, aluminum disk mounted on a chrome steel shaft, which operates with the disk either vertical or horizontal. Weight is under 3½ lb; size is 5½x6x3 in.

H. H. Sell Electric Co, Dept EW, 3240 Dakota Ave, Minneapolis 16, Minn.

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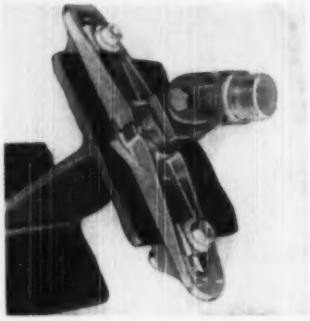

ADJUSTABLE BEAM CLAMP—A new adjustable beam clamp has been designed to suspend heaters, motor platforms, lighting fixtures, conveyors, and other types of overhead-mounted equipment from structural members of buildings. This cast malleable iron beam clamp is said to support loads to 1,500 lb. It is cadmium plated for corrosion resistance.

Thompson Electric Co, 1101-14 Power Ave, Cleveland 14, Ohio.

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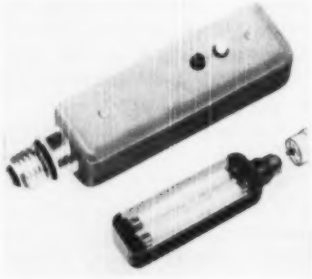


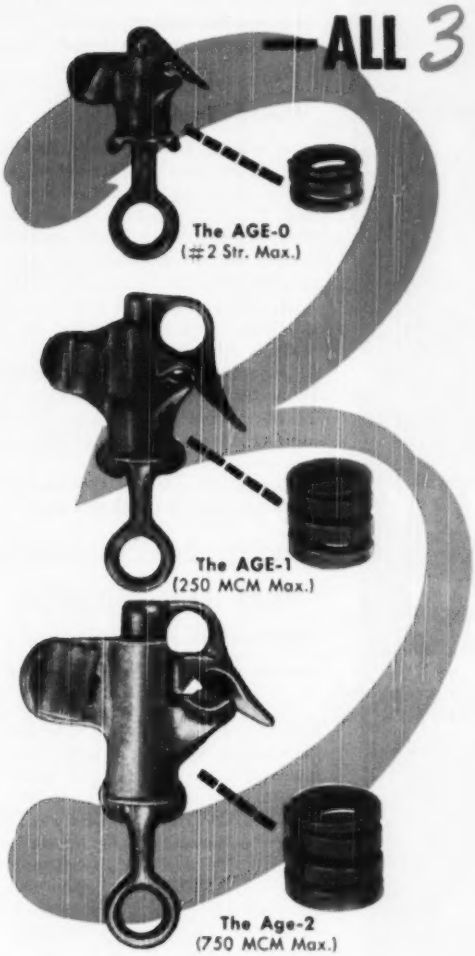
Fluorescent "Bulb"

Illumination up to 500 ft-c at 3 to 5 in. working distance is provided by the Lite-Mite Bulb which screws into an ordinary lamp socket. The "bulb" contains two 4-w fluorescent lamps

Thanks to Their Heavy-Duty Springs

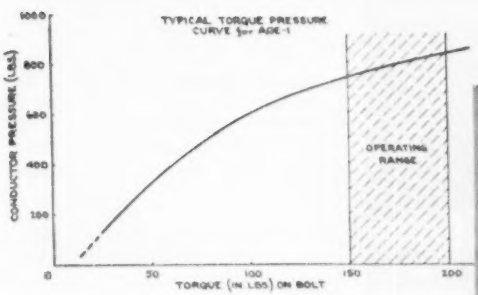
—ALL 3 FARGO *AGE* SERIES HOT LINE CLAMPS

Deliver the Maximum in Performance at a Minimum in Cost!



Specify any one of Fargo's AGE Series Hot Line Clamps — and you can depend upon its built-in heavy-duty spring to make it deliver the maximum in performance at a minimum in cost! It's the heavy-duty spring that compensates for the variables caused by fault currents . . . atmospheric changes . . . load variations . . . and the tendency of a conductor to "relax" or "flow" while under stress. Also, it's the heavy-duty spring that offsets the different torque linemen use in tightening connections — and makes the Fargo AGE Series Hot Line Clamps *vibration-proof!*

Fargo AGE Series Hot Line Clamps also have enough contact area, and mass, to avoid heating, as a result of fault currents — yet, they're light enough to be easily and quickly installed at the end of a stick.



FARGO

Manufactured by

FARGO MFG. COMPANY, INC.

Poughkeepsie, N.Y.

Distributed by

LINE MATERIAL COMPANY

(A McGraw Electric Company Division)

Milwaukee, Wisconsin

POWER TRANSFORMERS
Sizes
100 to 1000 KVA
. . . are easily and safely installed at load centers.
LIGHTING and POWER CIRCUIT TRANSFORMERS
Sizes 15 to 100 KVA for better and more efficient power distribution.
HEVI-DUTY
HEVI DUTY
LIGHTING CIRCUIT TRANSFORMERS
Sizes to 10 KVA for small lighting and power tool loads.
CONTROL CIRCUIT TRANSFORMERS
Sizes to 10 KVA. Designed specifically to handle the high inrush currents encountered in machine control.
It's the RELIABILITY of HEVI DUTY DRY-TYPE TRANSFORMERS ... that counts!
QUALITY in design
QUALITY in materials
QUALITY in workmanship
Many nationally known manufacturers of electrical equipment specify Hevi Duty Transformers for use with their products.
Write for Bulletin HD 499
HEVI DUTY ELECTRIC COMPANY
HEAT TREATING FURNACES HEVI-DUTY ELECTRIC EXCLUSIVELY
DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS
MILWAUKEE 1, WISCONSIN

and control components within a 2x6-in. shade which, it is claimed, never gets hot and rotates 300 deg for focusing. Aside from 115 v, 60 c, ratings of 220 v, 50 or 60 c, and 110 v dc can be supplied.

Stocker & Yale, Marblehead, Mass.

•

Wiring Tools

A stapling gun and a wire-guiding reel support have been announced for use in installing remote-control wiring. The stapling gun is for stapling light-weight thermoplastic remote-control wire to joists, studs, sheathing, etc. The gun, Catalog No. RA-1, has a controlled mechanism said to drive the staples to a predetermined depth without damaging insulation.

The reel support, No. RA-2, is said to permit remote-control wire to be payed-out smoothly and quickly. The support is made of corrosion-resistant zinc-plated wire.

General Electric Co, Construction Materials Dept, Bridgeport, Conn.

MORE NEW PRODUCTS about which you should know

Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa., has designed dc **indicating amplifiers** for low-level dc measurements as microvoltmeters, to extend range of Speedomax Recorders, and null detectors in place of galvanometers. Details are in Folder EM9-51(1). . . . Blackhawk Industries, Dubuque, Ia., offers two new **yard lights,** Models 512 and 514, wired with porcelain socket and No. 14 type "T" wire.

Thermo Electric Co, Inc, Fairlawn, N. J., is using Geon, a vinyl insulating compound, in the insulation of its **thermocouple lead wires.** They are intended for 105 C max temperatures. . . . Haydon Mfg Co, Torrington, Conn., has the Series 8010 **timer** with audible signal for large volume applications.

Holub Industries, Inc, Sycamore, Ill., is producing 10 sizes of **machine screw lead anchors** (screw thread size 6-32 to ¾-10) for installing machinery, fixtures, switches, conduit, BX, etc. . . . Phillips Mine and Mill

O.Z. ELECTRICAL MANUFACTURING CO.

262 BOND STREET, BROOKLYN 2, N. Y.

Representatives in all Principal Cities

They're O.K. if They're O.Z.

CONDUIT FITTINGS • CABLE TERMINATORS
CAST IRON BOXES • POWER CONNECTORS
SOLDERLESS CONNECTORS
GROUNDING DEVICES

CABLE SUPPORTS
CONDUIT TYPE

CABLE SUPPORTS
SPLIT TYPE

CONDUIT FITTINGS

INSULATED
BUSHINGS

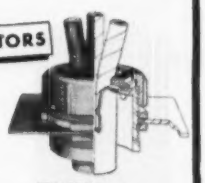
BAKELITE
BUSHINGS

SPLIT
COUPLINGS

EXPANSION
FITTINGS

CABLE TERMINATORS

TERMINATING
POTHEADS



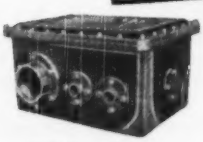
SEALING
BUSHINGS

COMBINATION
LUGS

COMBINATION
TWO-WAY
CONNECTORS

SOLDERLESS CONNECTORS

CAST IRON BOXES



EXPLOSION PROOF
TYPE

WEATHER PROOF
TYPE

COMBINATION
TEE AND
PARRELLEL CONNECTORS

GROUND
CONNECTORS

POWER CONNECTORS

T-CONNECTORS, TUBE
TO MULTIPLE CABLE TYPE

BUS BAR
CLAMPS

Improved and expanded, the O.Z. line of electrical fittings meets all engineering and design needs. Solderless Connectors, Cast Iron Boxes, Conduit Fittings, Cable Terminators, Power Connectors, Grounding Devices in all sizes are supplied. Special fittings made to individual specifications.

Write for O.Z. Calalog containing complete information on over 160 items.

APPROVED FOR R.E.A. USE

No. 1261

SUSPENSION TYPE INSULATORS

Dead End	No. 1261, 6" dia.
Ball and Socket	No. 1253, 10" dia.
Clevis Type	No. 1270, 7½" dia.
	No. 1271, 10" dia.

REINFORCED WIREHOLDER INSULATORS

Reinforced Type	No. 1937 2¼" Screw
Reinforced Type	No. 1937-3 3" Screw

No. 1937

No. 101

SPOOL TYPE INSULATORS

Secondary Rack	No. 101, 1¾" dia. Groove
Secondary Rack	No. 96, 3" dia. Groove
Service Rack	No. 100, 1⅜" dia. Groove

GUY STRAIN INSULATORS

No. 502, No. 534, No. 536, No. 538, No. 540 — Use dependent upon strength and cable requirements

No. 502

No. 175

PIN TYPE INSULATORS

One Piece Pin Type

No. 135 No. 175 No. 253
No. 261 No. 266

Multi-Part Pin Type

No. 2027 No. 2045 No. 2055

DEAD END CLAMPS, SUSPENSION CLAMPS AND FITTINGS

No. 261

Write for Complete Information and Prices

ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS

Supply Co, 2344 Jane St, Pittsburgh 3, Pa., has a collapsible 2,000-lb-capacity **materials handling** box for storing or moving bulk materials and parts; 5,000-lb-capacity available.

The Edwin F. Guth Co, St, Louis 3, Mo., is manufacturing the Lite-Blox line of recessed **troffers** of modular co-ordinated design. Information is in Bulletin 869.

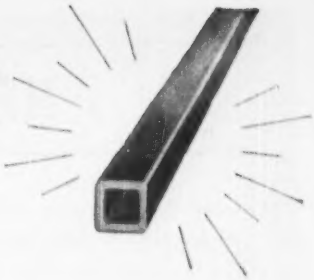
Sylvania Electric Co, 60 Boston St, Salem, Mass., has available pure **tungsten electrodes** having a melting point of 6,000 F for atomic hydrogen, helium, and argon arc welding. Details are in Bulletin 100. . . . All-Weather Springs, 140 Cedar St, New York 6, N. Y., has a **tension tester** for checking tensions or pressures in instruments, etc, primarily aircraft.

Mitchell Mfg Co, 2525 Clybourn Ave, Chicago, Ill., has announced a complete two-lamp **lighting system** of ten new luminaires. Called the Mid-Century line, the units have been designed for offices, stores, schools. Details in Bulletin 399. . . . A. O. Beckman, Inc, 11 W. State St, Pasadena 2, Cal., has developed an **oxygen analyzer** for power plants and industrial plants. No chemicals are used—a direct measurement is made upon the oxygen content itself, based upon a magnetic operating principle.

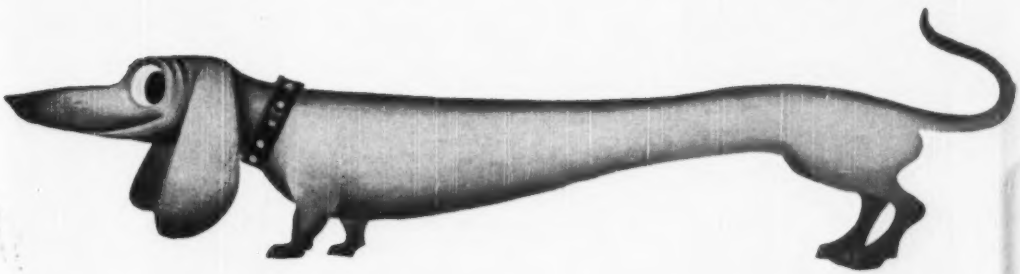
Hagen Mfg Co, Dept. 3, Baraboo, Wis., is manufacturing a **time switch** with combination electric and spring-driven clock in case of electrical outage. Will turn electrical equipment on and off once every 24 hr. . . . Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa., is producing the Universal **Roentgen Meter** for use in x-ray work and atomic fission research.

Otto Bernz Co, Inc, 280 Lyell Ave, Rochester 6, N. Y., has introduced a redesigned aluminum-tank **torch** weighing a little over 2 lb for general repair work. . . . United States Safety Service Co, Kansas City 6, Mo., offers an all-plastic **safety goggle** with interchangeable one-piece lens. Called the Saf-I-Duo, it fits over personal glasses. . . . O. Z. Electrical Mfg Co, Inc, 262 Bond St, Brooklyn, N. Y., has introduced Kwi-Cover, a **cover for electrical taps** that is said to eliminate taping on the company's solderless connections.

Chase square copper tube bus has great mechanical strength . . .



ALLOWS LONGER SPANS BETWEEN SUPPORTS



SAVINGS in time and cost of installation are often possible if Chase Square Copper Tube Bus Conductors are used. The square construction gives maximum mechanical strength *in all directions.*

High structural strength permits longer spans between supports. Ease of assembly and erection add to the saving in time and money. Since these square copper tubes have four flat sides, adequate and uniform pressure can be exerted between the large contact surfaces, resulting in firm, secure joints. They may be joined by clamping, bolting, or brazing.

That's why we say Chase Square Copper Bus Tubes are the finest you can buy. Write for full specifications and details.

LOOK AT THESE *Advantages*

1. Made of high electrical conductivity copper resulting in high thermal conductivity, low voltage drop and power loss per pound of metal.
2. Square construction provides maximum structural strength; essential in withstanding the very large forces caused by heavy short circuit currents.
3. Four flat sides allow adequate and uniform pressure to be exerted between the large contact surfaces, resulting in firm, secure joints.
4. Square, one-piece construction enables you to assemble conductors, fittings and supports without difficulty.
5. Copper is well known for its excellent resistance to corrosion.

Chase *the Nation's Headquarters for* BRASS & COPPER

WATERBURY 20 CONNECTICUT — SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . handiest way to buy brass

ALBANY ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DALLAS DENVER† DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† ST. LOUIS SAN FRANCISCO SEATTLE WATERBURY †Sales Offices Only

NEWS ABOUT PEOPLE

Lowery Takes Over Job of McIver in Ohio Utility

W. T. Lowery, assistant chief engineer of Toledo Edison Co since 1924,

W. T. LOWERY

has been appointed chief electrical engineer of the company. He succeeds the late George W. McIver.

A number of other appointments have been made by the Toledo utility. New division heads under Lowery are Johnston H. Hunt, F. C. Helwig, and Charles E. Flahie.

Hunt, formerly power plants and substations electrical engineer, has become planning and design engineer. Reporting to him will be John W. Cofer, advanced from assistant to system planning engineer, and LeRoy E. Smith, former assistant in plant and substation electrical engineering, now plant and substation electrical engineer.

Helwig, chief estimator, was named estimating and service engineer in charge of overhead and underground lines, records, right-of-way, and regulation.

Flahie, who has been superintendent of the meter department, was appointed transmission and distribution engineer, a new title in the company. He will have charge of transmission and distribution design, standards, performance analysis, and improvement recommendations. Reporting to him will be Melvin E. Geisert, newly named utilization engineer. Earle E. Diehl, meter foreman and former head of the meter standards laboratory, succeeds Flahie.

New superintendent of transmission and distribution in charge of overhead and underground lines is William H. Schwalbert. A. E. Maxwell, who formerly held this post, has been made superintendent of the Fremont division. Thomas J. Kozak, utilization engineer, has become methods engineer in the operating department, another newly created post.

Alfred W. Minick, formerly electrical superintendent of the Fremont division, has been named assistant superintendent of the overhead lines department of the Toledo division. He succeeds the late O. W. Buchanan.

Lowery has been with Toledo Edison since 1916. He is past chairman of the Toledo section of the American Institute of Electrical Engineers and past president of the Toledo Foremen's Club.

•

W. D. Frans has been assigned to the Wenatchee, Wash., office of the Bonneville Power Administration as district engineer. He was with Seattle City Light before joining Bonneville. The Wenatchee office was a branch of BPA's Seattle office until recently.

Leslie Surginer, assistant chief of the finance division of the Rural Electrification Administration, has been promoted to chief of the division. He succeeds **Joseph F. Marion,** who has retired after 15 years as division chief. Surginer was a fiscal officer with the Farm Credit Administration before joining REA in 1947.

Correction

In the caption for the picture of two new Triangle Conduit & Cable Co vice presidents (Oct 30, p 21) the titles of the new officers were transposed. Thomas M. Quinn was made vice president in charge of purchasing and Carl S. Menger, vice president in charge of sales.

Worthington Pump Picks Beck as Vice President

Harold K. Beck has been appointed commercial vice president in addition

HAROLD K. BECK

to his present office as manager of the Washington office of Worthington Pump & Machinery Corp, Harrison, N. J.

Beck joined Worthington's training course in 1925. Originally assigned to the export division, he was transferred to the Washington office the next year as a sales engineer. In 1933 he was appointed special representative for government contracts and in 1934 district manager of the Washington office.

•

William C. Lilliendahl has been appointed research advisory engineer for Westinghouse Lamp Division, Bloomfield, N. J. He will direct the research department's metals section. Lilliendahl joined the department in 1922 and has developed several processes for the preparation of uranium thorium, tantalum, and zirconium. His part in helping Westinghouse supply pure uranium for the first atomic pile in Chicago won him an atomic bomb citation from the War Department in 1946.

Ray L. Stout, right-of-way engineer for Pacific Power & Light Co for the past three years, will head property and right-of-way work for the new

Working Day and Night to Serve You

Here at Ryerson we're making an all-out effort to ease your steel-buying problems as much as possible.

No, we can't deliver all the steels you may need. Critical shortages growing out of the international situation prevent that. But what we can do—what we *are* doing is working shoulder-to-shoulder to see that you get every *available* item required as quickly as we can get it to you.

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Automatic Voltage Regulators
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Completely electronic in operation; has no moving parts. Offers instantaneous action, to maintain output voltage to within ±0.1 volts of nominal for any line voltage variations; to within ±0.15 volts for any load current change or load power factor change from .5 lagging to .9 leading. Waveform distortion *never* exceeds 3%.

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For large installations where high efficiency, zero waveform distortion and low cost are important; where instantaneous correction is unnecessary. Delivers constant output voltage regardless of variations in input voltage or load current.

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POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLIES • STABILINE VOLTAGE REGULATORS

Greek national power network now under construction with Marshall Plan funds under the direction of Ebasco Services, Inc. Stout has completed 40 years with PP&L and will take advantage of retirement rights to accept the new post. He worked for W. S. Barstow & Co before joining PP&L.

•

Wollaston Named to Head Design for B. C. Electric

Frank O. Wollaston, superintendent of transmission and distribution, has been appointed superintendent of the engineering design department of Brit-

F. O. WOLLASTON

ish Columbia Electric Co's engineering division in Vancouver.

Other new appointments include C. T. Eyford as supervisor of transmission and distribution engineering; J. L. Miller, supervisor of civil engineering; and F. M. Cazalet, supervisor of mechanical engineering.

Wollaston will be in charge of all design for the company's engineering projects other than the design of hydraulic works. He joined the company in 1943 after being with Commonwealth Edison Co. He is a member of the Association of Professional Engineers and the American Institute of Electrical Engineers.

•

Richard T. Stafford, assistant to the executive vice president of Allis-Chalmers Manufacturing Co's general machinery division, has retired after nearly 47 years of service. Stafford worked for Buffalo Railway Co, Manhattan Elevated Railway Co, and Lackawanna Steel Co before joining A-C's Buffalo district office in 1905. Later he was district manager at Seattle and assistant manager of the electrical

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That's a conservative estimate of the distance hi-pot lines are being carried on the broad, strong shoulders of Blaw-Knox Transmission Towers. This preference is due to our strict adherence to the engineer's specifications plus a generation of experience in working with structural shapes. And you pay no premium for Blaw-Knox quality.

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100 KVA Type F Transformer
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450 KVA, Type F Unit Substation,
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120/208Y, 4 wire.

Made by a pioneer in the dry type, air-cooled transformer field. Eliminate need for liquid filled units. No hazardous, inflammable oil or toxic liquid to fuss with. Maintenance of oil level, foreign matter, sludge accumulation, and subsequent filtering are relegated to the "horse and buggy days".

MARCUS DRY TYPE, AIR-COOLED TRANSFORMERS

ARE SAFE — No explosion or fire hazards. No fire proof vaults. Class B and C heat proof insulations.

ARE ECONOMICAL — Lower cost installation and operation, negligible maintenance.

For the transformer that's second to none, specify MARCUS.

ONE OF THE WORLD'S LARGEST MANUFACTURERS OF DRY TYPE TRANSFORMERS EXCLUSIVELY

1 to 2,000 KVA up to 15,000 Volts to meet Individual Requirements

- DISTRIBUTION
- GENERAL PURPOSE
- UNIT SUBSTATION
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- RECTIFIER
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PIONEERS IN THE FIELD OF AIR COOLED TRANSFORMERS

department in charge of sales and engineering at the Pittsburgh Works. His contributions to the electrical industry have included development of the divided protection gap for pole-type distribution transformers and the introduction of the cover bushing distribution transformer to this country.

•

General Electric Makes Engineering Assignments

Several new engineering appointments have been made by General Electric Co in its Construction Materials and Apparatus Departments.

Robert P. Allison, Jr, has been made assistant manager of the Conduit Products Division. He will be succeeded as manager of manufacturing for the Wire and Cable Division by Edgar A. Reiss. New manager of the New Kensington, Pa., Works is George Carlson. In the Apparatus Department William N. Oberly has been made assistant to Lisle D. Hodell, manager of manufacturing of the Fractional Horsepower Motor Divisions.

Allison, who has been with the company since 1935, has been a test engineer, methods engineer, and works manager of the Poughkeepsie and Lowell plants. Reiss joined GE in 1928 and has served as a plastics engineer and assistant superintendent of wire and cable. Most recently he has been a manufacturing engineer in the Wire and Cable Division.

Carlson will continue as manager of manufacturing for the Conduit Products Division. Oberly joined GE's test course in 1940 after two years with Nordberg Manufacturing Co, Milwaukee. He has served as a proposition engineer, group leader of the customer division in the Central Station Divisions, and head of the contract section of the Gas Turbine Engineering Division. Since 1945 he has been head of the unit generating section, Unit Equipment division.

•

Lt Col William R. Schuler has been named Los Angeles district engineer by the Army Corps of Engineers. He succeeds **Brig Gen Walter D. Luplow**, who will command an engineer brigade at Camp Rucker, Ala.

Allan C. Mustard, Jr, district manager for the South Carolina Electric & Gas Co at Beaufort for the past 12 years, has been appointed commercial man-

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- you use 2½" conduit for both
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- BUT Type RH carries only 224 amperes whereas higher-rated A.V.C. carries 296 amperes—a 32% increase in capacity.

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*From Chapter X—National Electrical Code—3 conductors in conduit—40°C-104°F.

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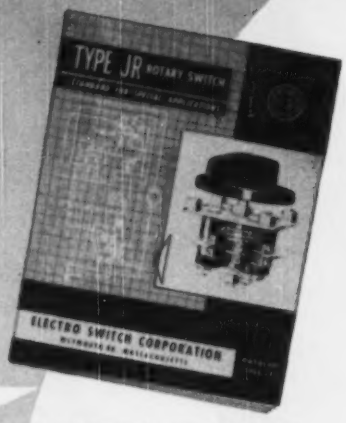

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YOU'LL FIND the new ESCO catalog 1950-JR a useful tool when you want to choose switches for special or standard services. It shows, in detail, how the single- and multi-fingered rotors, and the 4-, 8-, and 16-position detents, can be combined to suit an infinite variety of circuit control requirements.

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ager, a newly created post. **Daniel S. Lesesne, Jr,** electric distribution engineer at Charleston, will succeed him at Beaufort. Mustard joined the company in 1935. He was distribution engineer for the Charleston area before being named Beaufort manager in 1938. In his new job he will have overall supervision of all commercial activities of the utility.

Walter R. Seibert has been made controller of Sylvania Electric Products, Inc. He has been with Sylvania since 1942 as supervisor of plant accounting, manager of the internal auditing department, assistant to the controller, and assistant controller.

Brig Gen Ephraim F. Jeffe is retiring as a vice president of Consolidated Edison Co of New York, Inc. He joined the former Brooklyn Edison Co in 1916 as an assistant power engineer and in 1932 was named assistant to the vice president in charge of sales for New York Edison and United Electric Light & Power Co. He was elected a vice president of Con Ed in 1936 and returned from World War II military service in 1945 as vice president in charge of sales.

John E. Ryckman, one-time director of information for the Department of Interior in Washington, has been appointed information officer in Region II of the Bureau of Reclamation at Sacramento. He succeeds the late Max Stern. Before joining Reclamation he was director of public relations at San Francisco for the American Independent Oil Co.

Charles H. Eisenhardt, who started with American Steel & Wire Co's sales department as a stenographer 25 years ago, has been made manager of the electrical products sales division of the United States Steel subsidiary. He succeeds **T. F. Peterson** who has resigned. Eisenhardt has been assistant manager of the division since 1944.

Kenneth T. Gordon has been appointed purchasing agent of the Okonite Co, Passaic, N. J. He also will direct purchases for the company's Hazard Insulated Wire Work Division at Wilkes Barre, Pa., and for the Okonite-Callender Cable Co, Paterson, N. J. New assistant purchasing agent is **John L. Fabiny,** who has been in charge of metals and chemicals purchases. Most of Fabiny's 25 years with the company have been spent in

IN CHICAGO AND NORTHERN ILLINOIS...

Industries have Room to Grow

"The lofty oak from a small acorn grows"

Lofty oaks can't grow from little acorns without room for deep roots and spreading branches. And room to grow is as essential to industry as it is to mighty oaks.

Here in an area of 11,000 square miles, Chicago and Northern Illinois, there is a multitude of desirable plant sites all within easy access to the greatest industrial center of the United States, and yet all offer that advantage which is so essential in these days of industrial expansion—*decentralization and room to grow.*

Add to this the tremendous facilities in Chicago and Northern Illinois for transportation, marketing, research, education, culture and good living and you have a combination of industrial advantages unequalled elsewhere in the world.

Whether the requirements of your business are those of a characteristically compact industrial area or those to be found in smaller but easily accessible cities beyond, the Chicago and Northern Illinois area offers the wide diversity to include the type of space you need.

A LETTER TO US . . . describing your requirements will bring you a careful analysis of this area's advantages as they apply to your business. Or, if you wish, we will send you a carefully screened list of the available buildings or sites that would be suitable for your operations, based on the information you give us. We keep all such inquiries confidential. Just write us.

Industries in the Chicago Area have these outstanding advantages: *Railroad Center of the United States • World Airport • Inland Waterways • Geographical Center of U. S. Population • Great Financial Center • The "Great Central Market" • Food Producing and Processing Center • Leader in Iron and Steel Manufacturing • Good Labor Relations Record • More Than 2,600,000 Kilowatts of Power • Tremendous Coal Reserves • Good Government • Good Living • Good Services for Local Tax Dollars.*

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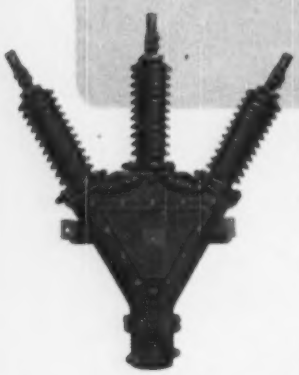
WESTERN UNITED GAS AND ELECTRIC COMPANY • ILLINOIS NORTHERN UTILITIES COMPANY

YOUR POWER CABLES ARE ONLY AS GOOD AS THE TERMINAL PROTECTION PROVIDED

Three E capnut style CABLE END BELLS have many outstanding features which assure trouble free operation.

1. Extra wide phase clearances.
2. Independently removable one piece porcelain bushings.
3. Bushings clamped to bell body, not cemented.
4. Adjusting nut on terminals to compensate for errors in cutting cable loads.
5. Side opening cover plate. (A great aid at time of installing.)
6. Oil resisting gaskets throughout.



Capnut style cable end bells are available in seven body shapes, for voltages 2500 to 46000 volts single conductor and to 23000 volt multiple conductor.

We also have a complete line of open bushing style of cable end bells for indoor service.

Write for bulletins 501 and 502.

Next time you have a cable terminating problem consult Three E.

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILLINOIS

ANCHOR
HIGH CAPACITY
METER SOCKETS

Designed and built to carry 200 amperes continuous load. Furnished with or without fully automatic circuit closers for by-passing meter. Silver-plated, specially designed jaws are highly resistant to any distortion.

All connectors suitable for #2 to #4/0 cable. Insulated plungers, operated by inserting meter, open by-pass. Heavy springs close by-pass completely before meter is fully removed from socket. By-pass will carry fully rated load. Write for Bulletin 4A.

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Factory — Manchester, N. H.
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the Hazard Division. Gordon joined Okonite's sales organization two years ago. He started in the sales department of Howard Ford & Co, Ltd, Liverpool, England, and later served in the overseas sales department of British Insulated Callender's Cables, Ltd.

Robert Jefferson Carter has been named Southwestern district manager for Stone & Webster Engineering Corp, with offices in the Esperson Building, Houston, Texas. He succeeds **A. T. Krook,** now president of Stone & Webster Canada, Ltd. Carter joined Stone & Webster in 1939 after 15 years of engineering experience in the petroleum industry. For the past two years he has been assistant chief process engineer of the engineering corporation.

Kenneth R. Geist, assistant to the director of purchases of Allis-Chalmers Manufacturing Co for the past two years, has been appointed director of purchases. He succeeds **Fred E. Haker,** retiring after 50 years of service. Geist, son of A-C Pres Walter Geist, started with the company in 1936. He has been in the blower and condenser department and has served as technical engineer-in-charge of the department's precision casting section. Haker joined A-C in 1900 as a stenographer and has been director of purchases since 1946.

Frank M. Osta has been appointed director of employee relations for Niagara Mohawk Power Corp. Osta has been with Niagara Mohawk and its predecessor companies since 1933 when he started as a clerk in the claims department. When Niagara Mohawk was formed last January he was made associate counsel for the new company.

OBITUARY

Samuel F. Smith, 74, former secretary and assistant treasurer of the old Northern New York Utilities, Inc, now part of Niagara Mohawk Power Corp, died Oct 31 in Watertown, N. Y. He had been in the utility field for nearly 50 years.

J. C. Thomas, 50, Southern division sales manager of Apex Electrical Manufacturing Co, died in Cleveland Nov 5. He was there to attend a sales meeting.

ELECTRICAL INSULATION IS OUR SPECIALTY

Q. *What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?*

A. UNITED STATES RUBBER COMPANY.

Q. *What ONE wire and cable producer makes plastics?*

A. "U. S."

Q. *What is the most important part of wire and cable?*

A. The insulation.

Q. *Who is best equipped to make wire and cable with superior insulation?*

A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.

Working with a valuable and rare electron-microscope in the laboratories of the United States Rubber Company. This microscope magnifies 100,000 times. The technician is examining compounding ingredients, one of the many steps taken to insure the finest insulation possible.

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U. S. Rubber has been a pioneer in insulation for over 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U. S." specialty!

Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U. S. Rubber.

SOME MORE OF THE MANY DIFFERENT VARIETIES OF "U. S." WIRE AND CABLE

UTILITIES: Power Cables · Street Lighting · Royal Cords · Network Cables · Utility Control · Pole & Bracket Cable · Service Entrance · Weatherproof · Zip Cord Pole Fixture Cable · Sup. Control

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HEAVY INDUSTRY: Power Cable · Royal Cords · Welding Cables · Control Cables · Machine Tool Wire · Building Wire · Switchboard Wire · Thermostat Cable · Bus Drop Cable

ONE OF MANY SUPERIOR "U. S." WIRE AND CABLE PRODUCTS

USKORONA-NEOPRENE POWER CABLES

Ozone-resistant for high-voltage applications in wet or dry locations.

These cables are for use on power distribution, street lighting and station control circuits and for general-purpose wiring on circuits up to 8000 volts between phases and at conductor temperatures up to 75 C. They will not crack after 3 hours in air containing .015 per cent ozone. They are light in weight, easy to install and join, and are resistant to oil, heat, sunlight, flame, acids, alkalis and corrosive chemicals. Uskorona-Neoprene cable also eliminates electrolysis. The following are guaranteed test values:

PHYSICAL AND AGING PROPERTIES (MINIMUM VALUES)

	Uskorona			Neoprene Jacket	
	Unaged	After 96 Hrs. O.B.	After 7 Day Geer Oven	Unaged	After 96 Hrs. O.B.
Tensile Lbs./Sq. In.	500	450	450	1800	1600
Elongation Per Cent	250	200	200	300	250

MOISTURE RESISTANCE (MAXIMUM VALUES)

Dielectric Constant and Power Factor of the insulation after immersion in water at 50 C.: Dielectric Constant, one day is 4.5; per cent gain, 1 to 14 days is 5.0; per cent gain, 7 to 14 days is 2.0; Power Factor, per cent, one day is 3.0; Stability Factor 40-80 volts/mil two weeks, per cent is .5.

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MANUFACTURERS and MARKETS

COMMEMORATING 25 YEARS of production, open house at East Stroudsburg, Pa., plant of Line Material Co drew more than 2,000 visitors the first day. After following the production process from raw material to finished product, guests viewed special exhibit of airport lighting, street illumination, wired radio, and hardware equipment. Factory Manager Louis Leffler, left, is shown above with State Sen Montgomery Crow, second from right, and group that took the plant tour

Utility Conductor Exempt for a Time from Cutback

Electric utilities last week were granted a temporary exemption from the National Production Authority's new order cutting civilian use of aluminum back to 65% of the average quarterly consumption during the first six months of this year.

Not hit by the order were aluminum conductor, transmission cable, and bus bars, ordered before Nov 13 for delivery before April 1. Other aluminum for electric utilities was not exempted.

The exemption, the order states, was made "pending development of requirements." Interior's Defense Power Administration, only tentatively established and manned by an acting and consulting staff, is working on electric utility aluminum requirements.

NPA indicated that the power industry also will get consideration as an essential activity in forthcoming cutbacks on copper use. DPA officials were drawing up a reporting form to be sent to electric utilities covering requirements for both aluminum and copper. Although the form had not been approved as ELECTRICAL WORLD went to press, it was hoped that the blanks would go in the mails soon.

The new NPA aluminum order also slapped a 60-day limit on inventories of aluminum products. Electric utilities and other aluminum users are forbidden from accepting orders that would push stocks beyond a 60-day supply or a "practicable minimum working inventory" (as defined by NPA's Sept 18 inventory control order), whichever is less.

•

New Cable Manufacturer in Georgia Is Expanding

A newly organized wire and cable manufacturer, Southwire Co, is expanding its facilities at Carrollton, Ga.

The company is installing a new production line for drawing and stranding copper and aluminum wire and cable and is adding an annealing furnace for production of soft wire. A new building, somewhat larger than the original steel and aluminum structure, is under construction.

Georgia's first wire drawing mill, Southwire was formed recently to make transmission and distribution wire and cable for utilities, municipalities, cooperatives, and contractors in the Southeast. Roy Richards, who operates the Roy Richards Construction Co, and has specialized in REA work, is president of the new concern. Vice president is Roger J. Schoerner.

•

Westinghouse Records Set in Third Quarter

The third quarter of 1950 was a record one for Westinghouse Electric Corp.

Net sales billed, bookings, and net income were the highest in the company's history. Production, measured by net sales billed, totaled $271,713,978 in the quarter, compared to $242,286,614 a year ago. For the first nine months this year net sales billed were $735,621,366; for the same period a year ago $710,360,596.

Net income, after taxes for the quarter, was $21,782,493, equal to 8% of net sales billed or $1.52 a share on the 14,109,949 common shares. This compares to $20,554,447 a year ago, equal to 8.5% of net sales billed or $1.54 a share on the 13,016,942 shares then outstanding.

For the nine-month period net income amounted to $49,079,200 or $3.37 a share compared to $48,964,408 or $3.64 a share in the first nine months of 1949. The third-quarter tax provision includes the recently enacted 4% increase in corporate income taxes on the nine-month profits, but no allowance was made for an excess profits tax.

In the first nine months of 1950 three times as much generating equipment was ordered from Westinghouse as in all of 1949, Pres Gwilym A. Price reported. He attributed the jump in demand to the general acceleration in industrial activity following the attack on South Korea and especially to electric utility expansion. Steam turbine orders have been placed with Westinghouse for delivery as far ahead as 1953. American manufacturing facilities are "adequate to meet

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VICTOR INSULATOR
THAT SAVES
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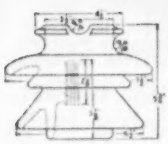
No. 245

BUILT FOR EXTRA LONG LIFE!



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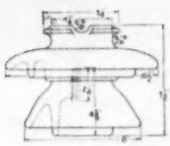

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VICTOR Catalog No.		127	245
Nominal Voltage Rating		27	45
60 cycle dry flashover	KV.	95	125
60 cycle wet flashover	KV.	60	80
Dry arcing distance	In.	7	9½
Leakage distance	In.	13	21
Pinhole diameter	In.	1⅜	1⅜
Cantilever strength	Lbs.	2,500	3,000
RNI (plain)	MV.	8,000	16,000
RNI (radio-freed)	MV.	100	200
1000 KC at applied	KV.	15	30

FACTS—*actual performance data* obtained from installations throughout the country—prove that VICTOR transmission pintype insulators *retain* their original high standards after *years and years* of severe service on the job. This means *extra* years of trouble-free insulator service.

The extra service-years you get in *every* VICTOR pintype insulator are a result of such built-in features as: Construction of the *best* high voltage porcelain, a rugged, *self-cleaning* design, and a *special "cushion" coating* at the joining surfaces that *eliminates* problems caused by thermal expansion.

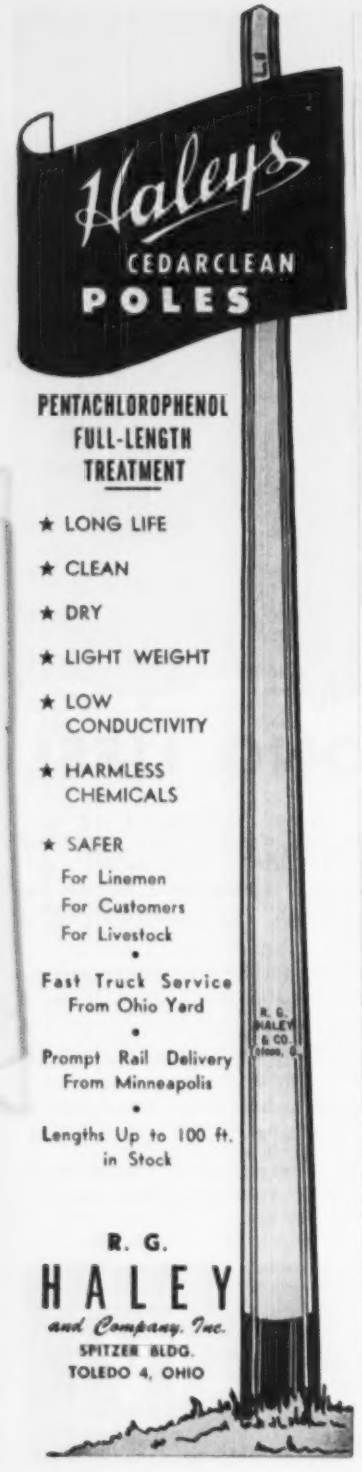
Reap the benefits of long, dependable service—*standardize* on VICTOR transmission pintype insulators.

For more information consult our new Condensed Catalog No. 4, write us, or call your VICTOR representative.

VICTOR
INSULATORS Inc.
VICTOR, NEW YORK

Look for this trade mark of enduring service

V



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Lengths Up to 100 ft. in Stock

R. G. HALEY and Company, Inc.
SPITZER BLDG.
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any foreseeable demand for production of land and marine turbines," he said.

MANUFACTURING BRIEFS

A modified wage and pension package plan has been agreed upon by the Federation of Westinghouse Independent Salaried Unions and Westinghouse Electric Corp, and the union's executive board has recommended ratification by locals. A former plan calling for a 10¢ hourly wage boost and pension and hospitalization benefits was turned down by the union membership. The new proposal is essentially the same as the rejected one except for three added features—revised rate reviews, upgrading procedures in like occupational classifications, and promotions to higher job classifications.

Chase Brass & Copper Co, Waterbury, Conn., and the Progressive Metal Workers Council, CIO, have negotiated a long-range settlement of wage and pension issues. The new three-year contract provides for eventual wage increases of 10¢ an hour, pensions of $100 to $125 a month for production workers at the age of 65 after 25 years' service; and increases of 1¢ an hour for each rise of 1.12 points in the Bureau of Labor Statistics' cost of living index. The immediate wage boost is 4¢ an hour, with 3¢ more next October and an additional 3¢ in October, 1952.

Appliance production by General Electric Co will be cut about 20% next year, H. L. Andrews, vice president in charge of the appliance and merchandise department, said recently. He reported diversion of materials to the rearmament program will force the reduction. Even so, he predicted, the industry will have to make more of a selling effort next year. Retail business in appliances is slowing down.

Oliver Iron & Steel Corp, Pittsburgh, has opened a new pole line material branch warehouse at 150 Howell St, Dallas.

Metal Prices
Nov 13, 1950

COPPER, Conn. V., lb	$ .24½
LEAD, N. Y., lb	.17
ZINC, prime Western, E. St. Louis, lb	.17½
TIN, Straits qual, N. Y., lb	1.34
ALUMINUM, ingot, base price	.19
NICKEL, base price	.48
STEEL, billets, Pitts., ton	53.00
STEEL scrap, No. 1 heavy, Pitts., ton	44.00

NOW you can bend Thin-Wall Conduit profitably

Here's the efficient way to bend 1¾, 1½ and 2" electro-metallic tubing. It's done with Blackhawk's remarkable all-directional "Porto-Power" hydraulic unit.

BENDING SHOES create kinkless, wrinkle-free bends matched offsets

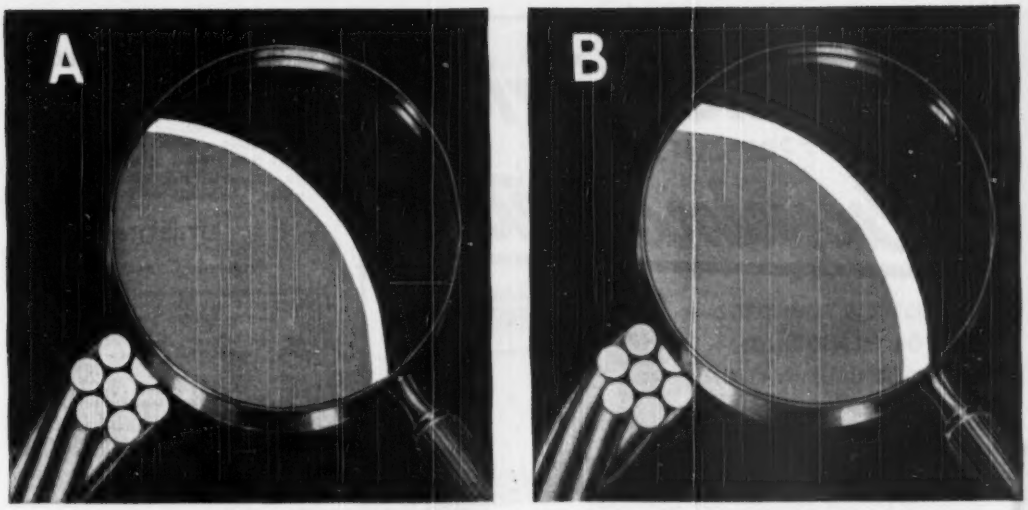
There's no crushing. You get 90° bends in just one setting. Remote-operation permits bending on the bench or floor — in the most convenient position for handling, sighting and measuring pipe.

ONLY Porto-Power gives you these benefits

The bending assembly for 1½" conduit weighs only 50 lbs. This means easy handling . . . no wrestling with heavy, clumsy equipment. The equipment pays for itself on the first good job.

Write for free Bulletin No. 50B on Benders for both Rigid and Thin-Wall Conduit . . . plus spectacular HYDRAULIC Knock-Out Punches. See leading wholesalers or write Blackhawk Mfg. Co., Dept. P-41110, Milwaukee 1, Wis.

BLACKHAWK



Bethlehem's A and B coatings. Note the extra heaviness of the B, which means years of extra service. Each coating has its uses, but even where A will do the job, B is often preferable.

The Strand Coating that Lasts TWICE AS LONG!

If you've been using Bethlehem strand with the A-weight coating (or another brand with extra-galvanized), here's good news. Good because it can save you lots of money.

The Bethlehem A is a mighty fine coating; but there are, of course, many locations where economy dictates a heavier jacket.

For instance, the Bethlehem B-weight. It's *twice* as thick as the A; will normally last twice as long — yet the extra first cost is *very small*.

Even in locations where the A is generally satisfactory, the heavier B-weight is often the logical choice. For, lasting twice as long, it naturally means less frequent strand replacement. And let us repeat: the slight extra cost of the B is as nothing, compared to its extra life.

Nowadays engineers want a strand that will last as long as pole structures treated by modern methods. That's why Bethlehem's heavier coatings are so often called for by farsighted utility companies. When you specify bethanized strand with the pure, electrolytic zinc jacket, you aren't limited to one coating weight — or even two. In addition to A and B, there's a still heavier grade, C, for extremely corrosive conditions. Thus strand life can be matched to the life expectancy of the line itself — with resultant economies.

We'd like to give you the full story. Why not ask our representative to spend some time with you and explain more fully?

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BETHLEHEM STEEL

Bendix-Friez
PRESENTS THE
Illuminometer

INDUSTRY'S NEW TOOL FOR MEASURING DAYLIGHT ILLUMINATION

The Bendix-Friez Illuminometer is ideal as an aid to correct light-load prognostication through correlation with weather data and other known system factors. Based on U. S. Weather Bureau designs, this new instrument provides continuous recordings of daylight intensity in hundreds of foot-candles. An internal filter neutralizes heat ray effects and means are provided within the unit for calibrating the sensing element against U. S. Government standards. The Illuminometer is built and backed by Bendix-Friez, world's largest manufacturer of weather instruments and principal suppliers to the Government for 75 years.

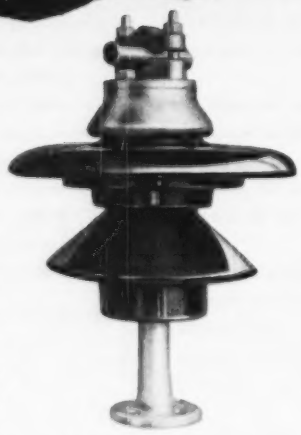
Write: FRIEZ INSTRUMENT DIVISION of
1306 Taylor Avenue • Baltimore, Maryland
Export Sales: Bendix International Division, 72 Fifth Ave., New York, N. Y.

Bendix AVIATION CORPORATION

GET THE BEST IN OUTDOOR BUS SUPPORTS—*Specify 3E!*

Your problem of supporting outdoor busses and connections can be satisfactorily solved by specifying the "Three E" Form D line.

Bus supports are available for flat bar, tubing, rod, cable or wire, in voltages ranging from 7500 to 69000. Nema standard insulators are used. Clamps are of rugged design and by use of a small adapter can be adjusted so that bus may be run at any angle to mounting surface. Husky malleable iron bases permit of mounting on pipe when so required.



Write for Bulletin 271 for complete details.

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILLINOIS

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Alabama—Central Alabama Electric Co-operative, Prattville, 325 mi. rural distr. line and sys. imprvs., Autauga Co. **$730,000.**

Arizona—Bureau Reclamation, Dpt. Interior, Phoenix, installing underground conduit runs for system operations and maintenance area, near here, Davis Dam Project, Spec. R3-PX-45 (Region 3). L. N. McClellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Arkansas—U. S. Eng., 300 Broadway, Little Rock, steel switchyard structures at Bull Shoals Powerhouse, Cotter, CIVENG-03-050-51-25.

Colorado—Y-W Electric Assn., Akron, rural distr. lines, Washington Co., **$485,000.** W. H. Burgwin, 2657 S. Broadway, Denver, consult. engr.

Colo., Trinidad—City, power distr. sys. within city, **$1,000,000.**

D. C., Wash.—U. S. Eng., First and Douglas Sts., N. W., Zone 25, transformer sub-station and misc. electrical work, beach erosion board, 5201 Little Falls Rd. N. W., Serial No. CIVENG 49-080-51-28.

Fla., Key West—Dpt. Navy, Charleston Naval Base, Charleston, S. C., replacing electric wiring sys., incl. enlarging outdoor sub-station, installing large capacity feeders at Boca Chica Naval Air Station. NOY 22635k Spec. 255228. Plans deposit $5.

Ga., Glynco—Dpt. Navy, Charleston Naval Base, Charleston, S. C., underground cables at Naval Air Facility, NOY 23456, Spec. 25823. Plans deposit $10.

Iowa—South Crawford Rural Electric Co-operative, Denison, rural distr. lines, Crawford Co., **$191,000.** Stanley Eng. Co., Hershey Bldg., Muscatine, consult. engr.

Ia., Cherokee—Cherokee County Rural Electric Assn., Cherokee, warehouse, shops with offices for REA Association, $73,000. Wm. Beuttler, Insurance Exchange Bldg., Sioux City, archts.

Louisiana—Louisiana Rural Electric Co-operative, P. E. Randol, pres., Alexandria, 140 mi. rural distr. lines, 2-2000 KVA sub-stations, incl. approx. 14 mi. 69 KV and 10 mi. 34.5 Kv trans. lines, Evangeline Co. **$300,000.** Freese & Nichols, 407 Danciger Bldg., Ft. Worth, Tex., consult. engrs.

Louisiana—South Louisiana Electric Co-operative Assoc., Houma, 75 mi. rural distr. lines, sys. imprvs. Terrebonne Co., **$425,000.**

Mich., Charlevoix—Northern Michigan Electric Co., Boyne City, steam power plant, **$2,000,000.** Stanley Eng. Co., Muscatine, Ia., engr.

Minn., Cambridge—State, Dpt. Admin., P. T. Peterson, dir., State Capitol, St. Paul, power plant addn. at State School and Colony, $323,000. Plans deposit $25. F. W. Jackson, St. Cloud, archt.

Oklahoma—Grand River Dam Auth., Vinita, relocation and rebuilding Markham Ferry-Okay 66 kva. transmission line, Wagoner Co. **$110,000.** Plans deposit $20. W. R. Holway, 302 E. 15 St., Tulsa, engr.

Texas—Southwestern Power Admin., P. O. Drawer, 1619, Tulsa 1, Okla., 12 mi. 66 kv. H frame, and 69 k.v. sub-station at Corrigan, Contr. ISPA-360, $180,000. Plans deposit $10.

Texas—South Plains Rural Telephone Assn., Lubbock, 1,976 mi. above ground exten. telephone lines and new lines, Lubbock area, **$750,000.**

Texas—Poka-Lambro Rural Telephone Co-operative, Tahoka, 2,970 mi. above ground rural telephone line extension and new lines, Lynn Co. **$850,000.**

Tex., Brownsville—City, doubling capacity electric power plant, **$2,600,000**; power distr. lines, **$400,000.** E. W. Watts, c/o owner, engr.

Tex., Caldwell—City voted bonds, electric power plant enlargement, reconditioning, **$225,000.**

Tex., Tahoka—Poka-Lambro Rural Telephone Co-operative, Tahoka, repair shop and storage, **$100,000**; main telephone plant expansion, **$321,000.**

Everything under control when Micah performs — and when MACALLEN mica is used. The best insulation will never get into your product unless it gets into your specifications.

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Midnight snack that pays off in pork chops

FEED hogs at midnight?—One farmer does, and finds it pays. He fills troughs, then wakens swine with floodlights. Soon they are greedily enjoying their "snack." When lights go out, the animals retire—to grow pork chops while they sleep! Odd?—Perhaps; but this is one more example of the uses for electricity on the farm!

With rural electrification, comes the need for efficient pole-line insulation. Hemingray Power Insulators have answered this need with complete dependability.

No. 680 for 15,000 volt lines. The technical standards committee of the Rural Electrification Administration has approved Hemingray Insulators No. 670, No. 680 and No. 514 under the limits of AIEE Specification No. 41-1944 for use on REA lines.

HEMINGRAY
POWER INSULATORS

American Structural Products Company
Muncie, Indiana
Subsidiary of Owens-Illinois Glass Company

Low Bidders & Contracts Awarded

Arizona-California-Nevada — Bureau Reclamation, Dpt. Interior, Boulder City, Nev., installing turbines, transformers, appurtenant equip. for Units A3, A4 and A9; relocation transformer bank Y, constr. addnl. transformer circuit and terminal facilities for Hoover switchyard at Hoover Power Plant, to C. M. Elliott & John C. Gist, Reading, Calif., **$1,777,242.** Est. $1,387,234. Bids 9/28, awarded 10/23.

Colo., Colorado Springs—City, City Hall, power plant equip. incl. turbo generator, from General Electric Co., 650 17 St., Denver, base, **$456,864**; escalator, **$501,-600**; condensor, from Worthington Pump & Mchy. Corp., 1640 Blake St., Denver, base, **$74,700**; escalator, **$32,170.**

Conn., Norwich—State, R. S. Thatcher, comptroller, State Capitol, Hartford, Oct. 31, power plant at Norwich State Hospital, B/A-K-51, from F. H. McGraw Co., 720 Windsor St., Hartford, **$672,443.**

Fla., Jacksonville — City, City Hall, transformers, controls at sub-stations at Venetia, Lake Shore and West Beaver Sts. for new electric plant, to Westinghouse Electric Co., Union Bank Bldg., Pittsburgh, Pa., **$110,401.** Bids 10/17, awarded 11/2.

Fla., New Smyrna—City, power plant, with 2 generators switchgear complete, to National Supply Co., P. O. Box 540, Springfield, O., **$211,000.** Reynolds, Smith & Hills, 227 Park St., Jacksonville, engrs.

Idaho, Arco—Idaho Operations Office, Atomic Energy Comn., Idaho Falls, one 30x50 ft. and two 30x60 ft., rein.-con. electrical sub-station control houses, AT (10-1)-144, to J. K. Thayn, 2670 Berkeley St., Salt Lake City, Utah. **$91,600.** Bids 9/29.

Tex., Lubbock—City, Oct. 19, power plant project, boiler plant unit only, from Tennant Co., Gulf Bldg., Houston, **$149,-132***generating unit, from Brown Boveri Corp., 19 Rector St., New York, N. Y., **$245,000***condenser unit, from Westinghouse Electric Corp., 1314 Texas Ave., Houston, **$65,385.** G. K. Harris, city engr.

Tex., Rama—International Boundary and Water Comn., U. S. A. and Mexico, 1st. Natl. Bank Bldg., El Paso, Tex., Falcon Dam and power plants lower Rio Grande, Schedule 1, U. S. A. portion of work to C. F. Lytle Co., et al 250 Insurance Exchange Bldg., Sioux City, Ia., **$7,801,064***Schedule 2, Mexican portion of work to Constructora Intercontinental, S. A., Mexico, Lamie Constr. Co., 1647 Exchange St., Oklahoma City, Okla., Edward Peterson Co., 903 WOW Bldg., Omaha, Neb., Tellensen Constr. Co., 1710 Telephone St., Houston, Tex., Foley Bros., Inc., 900 New York Bldg., St. Paul, Minn., Maseman Constr. Co., 26 W. 9 St., Kansas City, Mo., Lytle Constr. Co., 250 Insurance Exchange Bldg., Sioux City, Ia., San Ore Constr. Co., McPherson, Kan.) 68,525,983 pesos.

Wash., Tacoma—City, City Hall, erecting welded steel penstock, Unit 3 at Cushman Power House 2, to Willamette Iron & Steel Corp., 2050 N. W. Front St., Portland, Ore., **$237,073.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ill., Chicago—University of Illinois, Urbana, plans by C. Herrick Hammond, State Armory, Springfield, drug plant experiment station, **$570,000**; nurses residence and school, **$2,100,000**; East Dentistry-Medicine-Pharmacy Bldg., **$6,340,000**; experimental research bldg., **$1,300,000**; student and staff housing **$1,885,566**; second and third stages of hospital alterations and remodeling hospital facilities, **$2,000,000**; remodeling, impv. buildings, grounds and utilities **$365,000.**

Minn., Minneapolis—University of Minnesota, P. S. Callaway, purch. agt., 323 Admin. Bldg., Main Campus, furnishing, fabrication, erection 2,000 tons structural steel for 22 story, hospital for Mayo Memorial Medical Center. Total cost $12,-000,000. Plans deposit $25. C. H. Johnson, 715 Empire Bank Bldg., St. Paul, archt.

Ore., Coos Bay—Coos Bay Lumber Co., Coos Bay, plans by Plywood Research Foundation, 620 E. 26 St., Tacoma, Wash., hardboard plant, **$1,250,000.**

Va., Richmond—State of Virginia, Richmond, Virginia Museum of Fine Arts addn., Boulevard, **$1,390,000.**

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Self priming and interchangeable, Subox & Subalox lend themselves to simplified maintenance paint systems. All varieties have a distinctive basic pigment, chemically active suboxide of lead (Pb_3O).

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Substations — Try Subox High Gloss Enamels for transformers and switch gear. Subalox varieties adequately maintain meters, fences, etc.

Generation — Acid Resisting Varieties of Subox assure protection for coal handling equipment and hydro structures.

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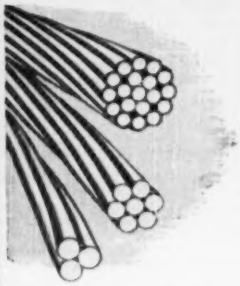
PAGE

Stainless Steel

STRAND

and Stainless-Copper

CONDUCTORS



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Compared with other types strand of equal breaking strength, they . . .

- have 30-40% greater overload capacity within elastic limit
- resist corrosion all the way through —not merely through a thin case of soft metal
- offer highest tensile and vibration-fatigue strength (tensile strength 235,000 psi; corrosion-fatigue limit 50% of ultimate)

Here's HOW they Save

- They permit longer spans—therefore require fewer poles per mile.
- Being lighter, they are easier and faster to install in the field.
- More resistant to destructive factors, they last many times as long before replacement.

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TENTH
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INTERNATIONAL HEATING & VENTILATING EXPOSITION
COMMERCIAL MUSEUM, PHILADELPHIA, PA.
JANUARY 22-26 1951

Management International Exposition Company

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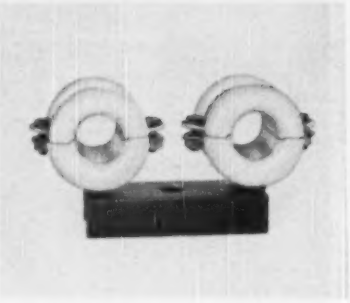
They are available for insulated conductors ranging from 5/16" to 3½" outside diameter, for pipe or flat mounting, single or multiple conductor.



In factories, mills, mines, power and substations, vaults etc., they make an ideal device for supporting cable runs and all open wiring.

Send for bulletin 201. It describes, illustrates and dimensions the complete line.

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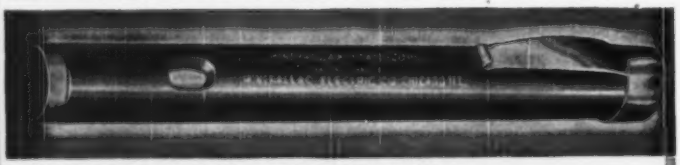
MELROSE PARK, ILLINOIS



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CATALOGS • BULLETINS

● POWER AND CONTROL CABLE: Dimensional data, as well as electrical and physical characteristics are presented in a 60-page catalog covering low and high voltage power cables, service cables, CAA approved airport lighting cables, street lighting cables, in addition to station control and municipal signal cables. There are complete discussions of the company's insulations and sheaths. Rome Cable Co, Advertising Dept, Rome Cable Corp, Rome, N. Y.

● POWER EQUIPMENT: Bulletin 25B-6150C briefly covers generation, distribution and control equipment. Included specific inclusions are steam and hydraulic turbines, generators and auxiliary equipment, transformers, voltage regulators, unit substations and CB's. Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee 1, Wis.

● CUTOUTS, CONNECTORS: New price sheets are available covering enclosed and open type cutouts and disconnecting switches, lightning gaps, Nutype connectors, Uniclamps, service entrance connectors and solderless lugs. W. N. Matthews Corp, 3850 Delor St, St. Louis 16, Mo.

● INSTRUMENTATION: Methods for accurate and rapid measurement of useful power with a check on reactive power to prevent overloading generators are described in a 4-page data sheet, No. 9.1-3. Minneapolis-Honeywell Regulator Co, Industrial Div, Philadelphia 44, Pa.

● IP SUN LAMPS: "Fluorescent Sun Lamps for Animal Husbandry" is a 4-page booklet describing uses of the fluorescent sun lamp in poultry raising and in connection with domestic and fur-bearing animals. Cost comparison and application data are presented. Westinghouse Electric Corp, Sterilamp-Tenderay Dept, Bloomfield, N. J.

● STEAM GENERATORS: Advantages of the dual circulation steam generator over conventional boilers are pointed out in "Dual Circulation Steam Generators for Power and Process Steam of Super Purity." Principals and applications of dual circulation are also discussed. Foster Wheeler Corp, 165 Broadway, New York 6, N. Y.

● SPEED REDUCERS: Type AT and RT worm gear speed reducers are completely described with dimensions and ratings in Bulletin 130. The units are the same type as in Catalog 200, but improvements have been incorporated. The Cleveland Worm & Gear Co, 3249 E. 80th St, Cleveland 4, Ohio.

● MATERIALS HANDLING: A 24-page catalog, No. 77, covers a diversified line of corrugated steel boxes, skids, pallets, and combination units. Intended uses of this line of "container-type" materials handling equipment are explained. The Union Metal Mfg Co, Canton 5, Ohio.

● OSCILLOGRAPH: Bulletin 303 contains information about the Type 303 quantitative 10-megacycle cathode-ray oscillograph. Allen B. DuMont Laboratories, Inc, Instrument Div, 1000 Main Ave, Clifton, N. J.

● CORROSION-PROOF CEMENTS: Information on resin, sulfur, silicate, and asphaltic cements is compiled in chart form to aid in selection of the correct cement, in Bulletin No. 5-1. The Atlas Mineral Products Co, 43 Walnut St, Mertztown, Pa.

● PRECIOUS METAL ALLOYS: Comprehensive technical and application data on precious metal alloys developed for use in industrial fields appear in Bulletin R-12.

"But you can't buy that kind of a motor..."

How many times
have you heard somebody
that ought to know better
say something like that about
motors, pumps, compressors or
what-have-you? And how many
times have you heard somebody
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about products and services
designed to help *you*
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about the latest developments
in *your* business,
your industry . . .
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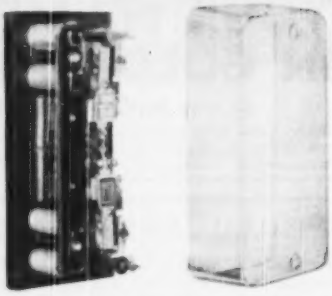

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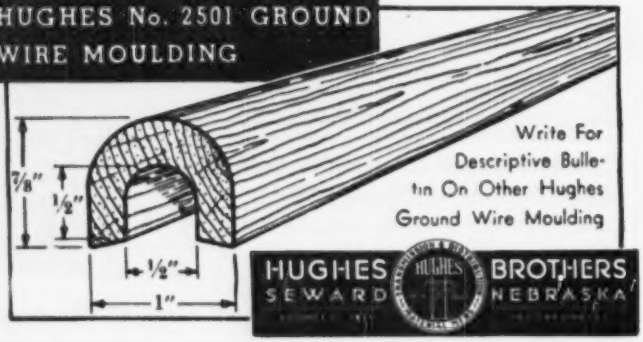

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● SYNCHRONOUS MOTORS: Publication B.32-200 is a 4-page brochure providing some information about the company's expanded line of high-speed synchronous motors. There are pictures of representative types of construction from 100 to 6,000 hp. The Electric Products Co, 1725 Clarkstone Rd, Cleveland 12, Ohio.

● FIREFIGHTING FOAM: A new brochure on air foam or mechanical foam for fire-fighting is available to companies having oil storage tanks and other large flammable liquid fire hazards. It describes air foam, methods of application, specifications and characteristics for five sizes of portable playpipes, foam proportioning tanks, etc. Pyrene Mfg Co, 560 Belmont Ave, Newark 8, N. J.

● ACSR MANUFACTURE: Operations are pictured and described in the new ACSR plant at Listerhill, Ala. Reynolds technical literature and consulting engineering service on cable are explained. Information is given on aluminum substations. Reynolds Metals Co, 2000 S. Ninth St, Louisville 1, Ky.

● CURRENT REGULATORS: Bulletin CCR-506 illustrates and describes the new static type constant current regulators for brightness control of series airport runway and taxiway lights. Hevi Duty Electric Co, Milwaukee 1, Wis.

● CATHODE RAY TUBES: Characteristics of 194 cathode ray tubes for oscilloscope, radar, and television are tabulated in a 12-page booklet. Sylvania Electric Products, Inc. Advertising Dept, Emporium, Pa.

● DC MOTORS, GENERATORS: Construction and assembly data, with illustrations, cover a variety of dc motors and generators from ½ to 200 hp, 1 to 150 kw, in Bulletin B1001. Star Kimble, 200 Bloomfield Ave, Bloomfield, N. J.

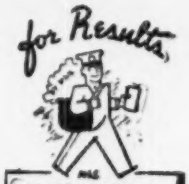
● MOTOR BEARINGS: Pre-lubricated bearing design is the subject of Bulletin B2201. There are drawings and a check list comparing the company's design to other bearing arrangements. Reliance Electric and Engineering Co, 1076 Ivanhoe Rd, Cleveland 10, Ohio.

● DUST COLLECTOR: A tubular dust collector that permits re-firing of high-carbon particles without re-circulating all the fly ash through the boiler is described, along with the process, in "P-D Decantation". Thermix Corp, Greenwich, Conn.

● TROLLEY BUSWAY: Catalog 25 contains information about Feedrail, an all-purpose trolley busway system of electrical distribution. Specifications, accessories, typical installations, and planning of installations are covered. Feedrail Corp, 125 Barclay St, New York 7, N. Y.

● STARTERS: Type RA magnetic starters and Type GRA magnetic contactors are presented in Form No. G-7005. Ratings, dimensions, and design data are given for sizes 0, 1, 2, 3, and 4. The Arrow-Hart & Hegeman Electric Co, 103 Hawthorn St, Hartford 6, Conn.

● SANITARY MOTORS: Features of sanitary motors, ½ to 7½ hp, are given in 4-color Bulletin 1607. U. S. Electrical Motors, Inc, 209 E. Slauson Ave, Los Angeles 54, Cal.



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F Lamp Ballasts—*Proposed American Standard Specification for Fluorescent Lamp Ballasts*, C82.1, has been published for a year's trial and criticism. In addition to definitions, there are specifications for ballast marking, ballast performance, and recommended operating temperature limits. The two previously published standards of the series are C82.2 and C82.3. This Standard may be obtained for 25¢ from American Standards Assoc, 70 E. 45th St, New York 17, N. Y.

Plastic Standards—Some 120 ASTM specifications and test methods are included in the fifth edition of *ASTM Standards on Plastics*. Covered are phenolic laminated sheet and tubing for radio applications, enclosures for small testing machines, tests at sub- and super-normal temperatures of electrical insulating materials. Price of the 624-page book is $4.85 from American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

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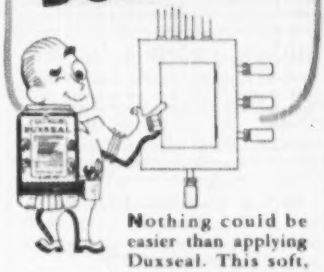

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BOX NUMBERS count as 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals.)

DISPLAYED RATE:

The advertising rate is $9.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

E. W.

NEW ADVERTISEMENTS received by Nov. 24th in the N. Y. office will appear in the Dec. 4th issue subject to limitations of space available.

ATOMIC POWER

Westinghouse Electric Corporation

Immediate Openings

For Experienced
Senior and Junior Engineers

- Circuit designers, sequence control and regulating systems.
- Designer of amplifiers for indication, detection and control functions.
- Designer for servosystems in the instrument range.

For application write—

Manager,
Technical Employment,
306 FOURTH AVE.
PITTSBURGH 30, PA.

WANTED

GRADUATE ELECTRICAL METER ENGINEER

Experienced in design and development of electric watthour meters.

Excellent opportunity with well established medium sized company.

P-8194, Electrical World
330 W. 42nd St., New York 18, N. Y.

ELECTRICAL DESIGNERS

ESTABLISHED BOSTON CONSULTANTS HAVE OPENINGS FOR ELECTRICAL ENGINEERS AND DESIGNERS WITH POWER PLANT AND INDUSTRIAL DESIGN EXPERIENCE.

P-7852, Electrical World
330 W. 42nd St., New York 18, N. Y.

WANTED

Power Station Engineer for Administrative Work

Education: B.S. degree in Mechanical (preferred) or Electrical Engineering from an accredited college or university.

Experience: Minimum of 10 years with at least 5 years in connection with steam-electric power generation. Work in operation, maintenance or efficiency desirable. Construction and design experience acceptable.

Age: 40—45.

Location and Industry: Large Pennsylvania electric utility.

Salary commensurate with qualifications.

Please send personal record to

P-8164, Electrical World
330 W. 42nd St., New York 18, N. Y.

TREE TRIMMING SALESMAN WANTED

Salesman with force and initiative to sell tree trimming and chemical spray brush control of right of ways. Necessary to have background knowledge of transmission and distribution. This position requires year round traveling in Southern and Southwestern states. Must have late model car. Salary, commission and expense account. Give full details in first letter to

EILAR TREE EXPERTS
P. O. Box 1039 Houston, Texas

WANTED TO BUY

For Cash

YOUR SURPLUS

ELECTRIC MOTORS
MOTOR STARTERS
OIL & AIR CIRCUIT BREAKERS
CABLE-WIRING MATERIALS
PANEL BOARD FITTINGS
SPEED REDUCERS
COPPER WIRE

INDUSTRIAL ELECTRIC & SUPPLY CO., INC.
37-1681—Memphis, Tenn.—Box 1398

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES
No lengths too long or too short
Telephone: Eastgate 7-4778
PIERCE CABLE CO.
2670 Clybourne Ave. Chicago 14, Illinois

MOTORS, GENERATORS, TRANSFORMERS
1 – 1500 H.P.
Bought and Sold
New and Rebuilt
ELECTRIC EQUIPMENT CO
ROCHESTER 1, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

RURAL COOPERATIVE Power Association Elk River, Minnesota. Taking applications for all classes of Power Plant Operators. Mail attention J. M. Cox, Superintendent.

WANTED—GRADUATE Electrical or Mechanical Engineer with 10 years experience in Transmission and Substation work with Public Utility by manufacturing company in Western New York. Should be prepared to do some traveling. Salary dependent on experience. P-8034, Electrical World.

FIELD ENGINEER for Hydraulic Division of Electrical Department large Copper Company Chile, South America. Three-year contract, transportation both ways and salary while traveling paid by company. In reply give complete details. P-8074, Electrical World.

ASSISTANT OFFICE Engineer (Junior Electrical Engineer) for compilation of data, reports, equipment records and requisitions for purchase of material covering electrical equipment entire property of large Copper Company in Chile, South America. Single man preferred. 3-year contract. Transportation both ways and salary while traveling paid by Company. In reply give complete details. P-8148, Electrical World.

WANTED-SALES Supervisor to assist Sales Manager Transformer Division of old established manufacturer. Prefer engineering graduate with both field and headquarters sales experience. Must be able to supervise headquarters staff and all necessary sales office procedures. Excellent starting salary with opportunity for advancement. In reply give complete details. P-8230, Electrical World.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service. (40 years recognized standing and reputation). The procedure of highest ethical standards is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

SCHOOL

Electrical Meter Engineering
"The Profession With a Future"

Meter Department demands are bringing good opportunities to meter experts.
HOME STUDY COURSE
Practical up-to-date home study covers all phases of Meter Work
Write Today for Free Booklet
Fort Wayne Correspondence School
Dept. 11B, 201 Dime Bank Bldg., Fort Wayne 2, Ind.

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

EBASCO SERVICES INCORPORATED
(APPARATUS EXCHANGE)
Two Rector St., New York 6, N. Y.

Save 80%

¼" Guy or Messenger STRAND

Galvanized 6 Strand Wire Rope. Cotton Center, Rt. Lay, Preformed. Breaking Strength Over 6600 Lbs.

Two Shipping Points
LOS ANGELES, CALIF.
PHARR, TEXAS

Only 1¢ per foot

By Spool
Spools—7100' & 8000'

GLICK TWINS
PHARR, TEXAS

FOR SALE

G. E. Elec. Induction Motor No. 5283051
Type MT 28-2500-257. Form E
Volts 6600. Cyc. 60-Amps. 202 H.P. 2500
Secondary volts 706. Secondary Amps. 1530
Speed, full load 253 RPM Phase 3
2500 H.P. continuous-40 degree C. Rise
G. E. Elec. Controls:
G. E. Liquid Reostat, Cat. No. 4990236. Size 204 Cr 9291.

H. P. GUION
Dredges
383 W. 42nd St. New York, N. Y.

ELECTRICAL CABLE

- for every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular supplier.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2670 N. Clybourn Ave., Chicago 14, Ill.

FROM AVAILABLE STOCK

TURBO GENERATORS

Qu	KW	Make	Desc.
2—	750	G.E.	Condensating—250 lbs. I.S.P. 440 v. 3 ph. 60 cy.—Built 1944
1—	625	Westg.	Non-cond. 125 lbs. I.S.P., 8/30 lbs. B. P.-440 v. 3 ph. 60 cyn.
1—	400	Westg.	Non-condensating—125/150 lbs. I.S.P. 5/10 lbs. B.P.—240/480 v. 3 ph. 60 cy.
1—	300	G.E.	Non-condensing 180/175 I.S.P. 5/10 B.P.—480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

	KVA	Make	Type	Volts	Speed
1—	6140	Whse.		2400/4160	600
1—	4000	G.E.	ZDC	2400/4160	900
1—	3000	Whse.		2400/4800	720

MOTOR GENERATOR SETS

3 ph., 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
2—	3000	G.E.	300	600/32 cy	11000
1—	1800	G.E.	600	115/230	2300/4150
1—	1500	G.E.	360	275	2300/4400
1—	1500	G.E.	600	600	2300/4150
1—	1250	G.E.	600	275	4150
1—	1000	Whse.	900	600	4150
1—	750	Whse.	900	275	2300/4150
1—	750	Allis Ch.	720	250	440/2300

TRANSFORMERS—60 Cycle

K	Make	Type	Ph	Voltages
3—2000	Whse.	OISC	3	66000Y/11000
1—2300	Al. Ch.	OISC	3	13200/2300
3—1250	G.E.	RVTDJ	3	9053/650
1— 600	Al. Ch.	OISC	3	2300/4150/2300/440
3— 333	Pitts.	OISC	1	2040/2300

FREQUENCY CHANGERS

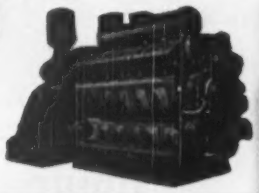
1—	500 KW	A. C.	25/60 cy.	11000/2300 v
1—	1000 KW	GE	25/60cy.	2300/4150
1—	2500 KW	G.E.	25/60cy.	2300/4150

BELYEA COMPANY, INC.

OFFICE & SHOP
51 Howell St., Jersey City 6, N. J.

DIESEL POWER

FOR
IMMEDIATE SHIPMENT
UNIT CAPACITIES—10 TO 1875 KVA
A.C.—50 AND 60 CYCLES
VARIOUS VOLTAGES



A PARTIAL LISTING OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	38F16	2600	300	210	Enterprise	DSG-6	440	514
1440	Fairbanks Morse	38D8½	1900	720	680	Superior	KVA	1000	514
1500	General Motors	16-278A	1400	720	313	General Motors	6-268A	485	1200
937.5	General Motors	12-567	1080	720	313	Clark	MD-6	375	327
625	Atlas	6-13¼x18T	800	327	187	Ingersoll Rand	D	275	514
450	Baldwin	VO-6	510	450	156	General Motors	4-268A	180	1200
400	Busbayo	80	480	600	75	General Motors	6046C	90	1200

D.C. UNITS ALSO AVAILABLE

A. G. SCHOONMAKER COMPANY, INC.
ENGINE DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V, 2300V Pyranol
1—1000 KVA G.E., 3 Ph., 4150V, 2400V
1—1000 KVA G.E., 3 Ph., 4150V, 2 Ph., 2400V
1— 500 KVA Kuhlman, 1 Ph., 4150V, 2300V
3— 400 KVA G.E., 1 Ph., 6600V, 2300V Sec.
3— 100 KVA G.E., 1 Ph., 4150V, 240/480 Sec.
3— 75 KVA Whse., 1 Ph., 2200V, 440V Sec.
1— 75 KVA G.E., 3 Ph., 2400V, 240/480V Sec.

MOTOR GENERATOR SETS

2—1500 KW G.E., 600V, 600 RPM, 4000V Syn.
2—1250 KW G.E., 275V, 600 RPM, 4000V Syn.
1—1000 KW G.E., 600V, 514 RPM, 4000V Syn.
2— 150 KW G.E., 125/250V, 1200 RPM, 4000V Syn.

SLIP RING MOTORS

1—2500 HP G.E., WT, 257 RPM, 6600V
1— 500 HP G.E., WT, 720 RPM, 2200V 4150

SYNCHRONOUS CONDENSER

1—2500 KVA Whse., 720 RPM, 2200V with D.C. Exc.

Large Stock of A.C. and D.C. Equipment

TRANSFORMERS

BOUGHT AND SOLD
We carry a large stock of transformers, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS
We rewind, repair and redesign all makes and sizes.
One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

A-12A

IF IT'S

here...

IT'S news...

IT'S WORTH
STOPPING TO SEE!

Maybe industry doesn't maintain show windows on Fifth Avenue or State Street or Wilshire Boulevard like America's great department stores. But your industry has a mighty effective show window... and this is it... this magazine. In these advertising pages alert manufacturers show their wares. Here you will find up-to-the-minute news about products and services designed to help you do your job better, quicker, and cheaper. To be well-informed about the latest developments in your business, your industry... and to stay well-informed... read all the ads too.

McGRAW-HILL
PUBLICATIONS

LETTERS TO THE EDITOR

Washington Comment

To the Editor:

We have read the Washington Comment column in your September 11 issue, page 106, about the report of the House Committee on Executive Expenditures. I am sure there is no reason why a less biased approach should have been expected, despite what you told me about your desire to present "both sides."

I recognize that we left the way perfectly open for you because we did not feel that we could properly avail ourselves of your invitation to comment on the Committee's report. Even taking this into account, the devious intermingling of innuendo with excerpts of the report selected to give a distorted picture makes the column grossly unfair. This is aside from the editorial pronouncements, such as "the taxpayers are the losers" which neither the report nor any other facts justify in any way.

George W. Haggard
Deputy Administrator
U. S. Department of Agriculture
Rural Electrification Administration
Washington 25, D. C.

(Editor's Note: We regret that we have been unable to secure any statement from REA regarding items in the House Committee report. We are informed that most of the practices criticized in the report have been corrected.)

The Power of a Woman

To the Editor:

Reference is made to letter on "Female Meter Readers" in the "Letters to the Editor" column of the October 9 issue and to your note, "Any prior claims?"

During the First World War, in 1917 and 1918, I was manager of the Colonial Power and Light Co and the Claremont Power Co in Vermont and New Hampshire. In order to release some of our men for military service we employed a girl to read meters. This proved very satisfactory except that she had difficulty with some of the meters which were located in hard-to-get-at attics, as was the style in those days. Incidentally, she eventually married one of the customers.

As we lost the operators in the hydro plant their wives or best girls took over their jobs. At one time all of the power house crew were girls except for the Superintendent and maintenance man. The girls did an excellent job but felt bad that we insisted they wear coveralls around the machinery. There was also a girl on one shift and a man with one arm on another shift in the dispatching office. Happily, all of the men came back from the war and the girls were glad to give them back their jobs.

Consideration was given to the use of girls on the street railway, but as this particular line handled a large amount of heavy baggage this did not appear practical.

J. G. Menut
4010 25th Road North
Arlington, Va.

(Editor's Note: NOW are there any prior claims?)

Proposed Construction

To the Editor:

In the October 16th **Electrical World** under "Proposed Construction," it is stated that the Western Electric Cooperative, Inc, Anadarko, Oklahoma, contemplates the acquisition of steam turbines and that the C. H. Guernsey & Co are the engineers. This is in error. Actually the Western Electric Cooperative, Inc, took prices on two 15,000-kw steam turbine driven hydrogen-cooled generators on October 13, 1950. The proposals ranged in price from $918,000 to $1,067,000. Furthermore, C. H. Guernsey & Co is not the engineer in charge of this plant as it is being designed by and constructed under the supervision of our company.

A contract for the furnishing of equipment was awarded to the Elliott Co.

Eugene C. Land
Vice President
Laramore and Douglass, Inc.
79 E Adams St
Chicago 3, Ill

Let's look at the "MK-40" BLADE MECHANISM

Designed to give you smoother operation —longer service

One 45-degree blade actuating mechanism replaces arrangements of cranks, levers, links and cams so common on ordinary switches . . . converts motion of operating insulator to a vertical lifting and rotating motion of the blade in just the right sequence and with just the right mechanical advantage. Blade is under positive control at all times. Toggle effect of the mechanism locks the blade in fully closed and fully open positions.

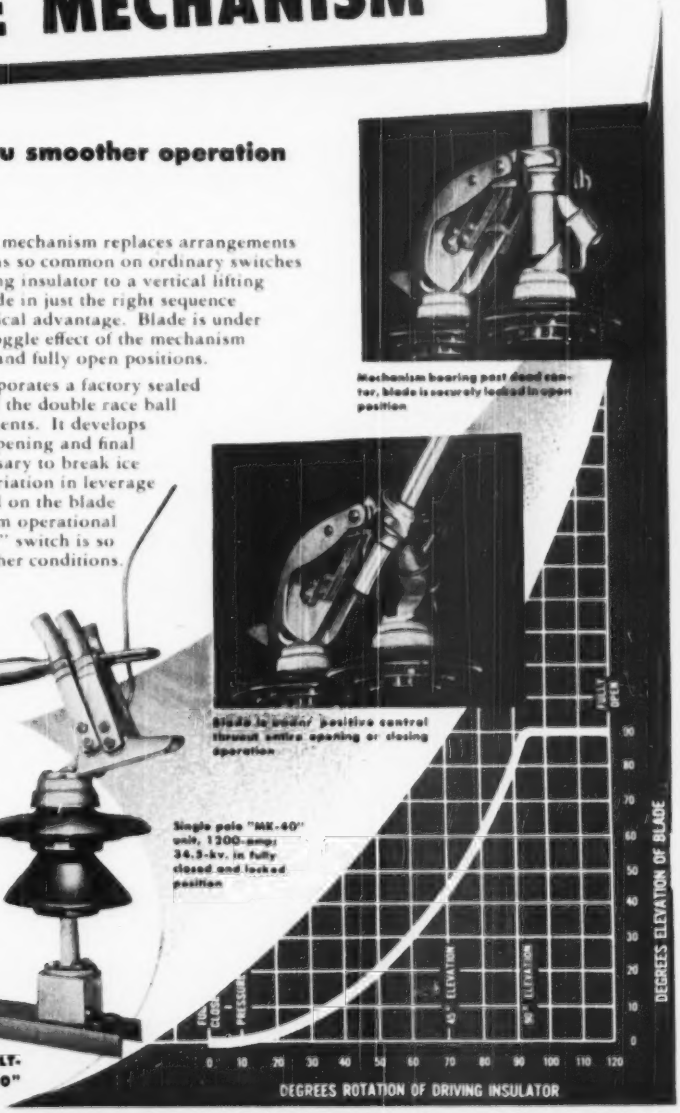
This mechanism incorporates a factory sealed greaseless bearing assembly of the double race ball type requiring no field adjustments. It develops enormous leverage in initial opening and final closing; where it is most necessary to break ice accumulation or corrosion. Variation in leverage equalizes the gravitational pull on the blade and results in a smooth uniform operational effort. That's why the "MK-40" switch is so easy to operate under all weather conditions.

Ask for Publication 4807.

Mechanism bearing past dead center, blade is securely locked in open position

Blade is under positive control throughout entire opening or closing operation

Single pole "MK-40" unit, 1200-amp; 34.5-kv, in fully closed and locked position


FULLY OPEN
45° ELEVATION
90° ELEVATION
DEGREES ELEVATION OF BLADE
0 10 20 30 40 50 60 70 80 90 100 110 120
DEGREES ROTATION OF DRIVING INSULATOR

WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHES SPECIFY THE "MK-40"

DELTA-STAR ELECTRIC COMPANY

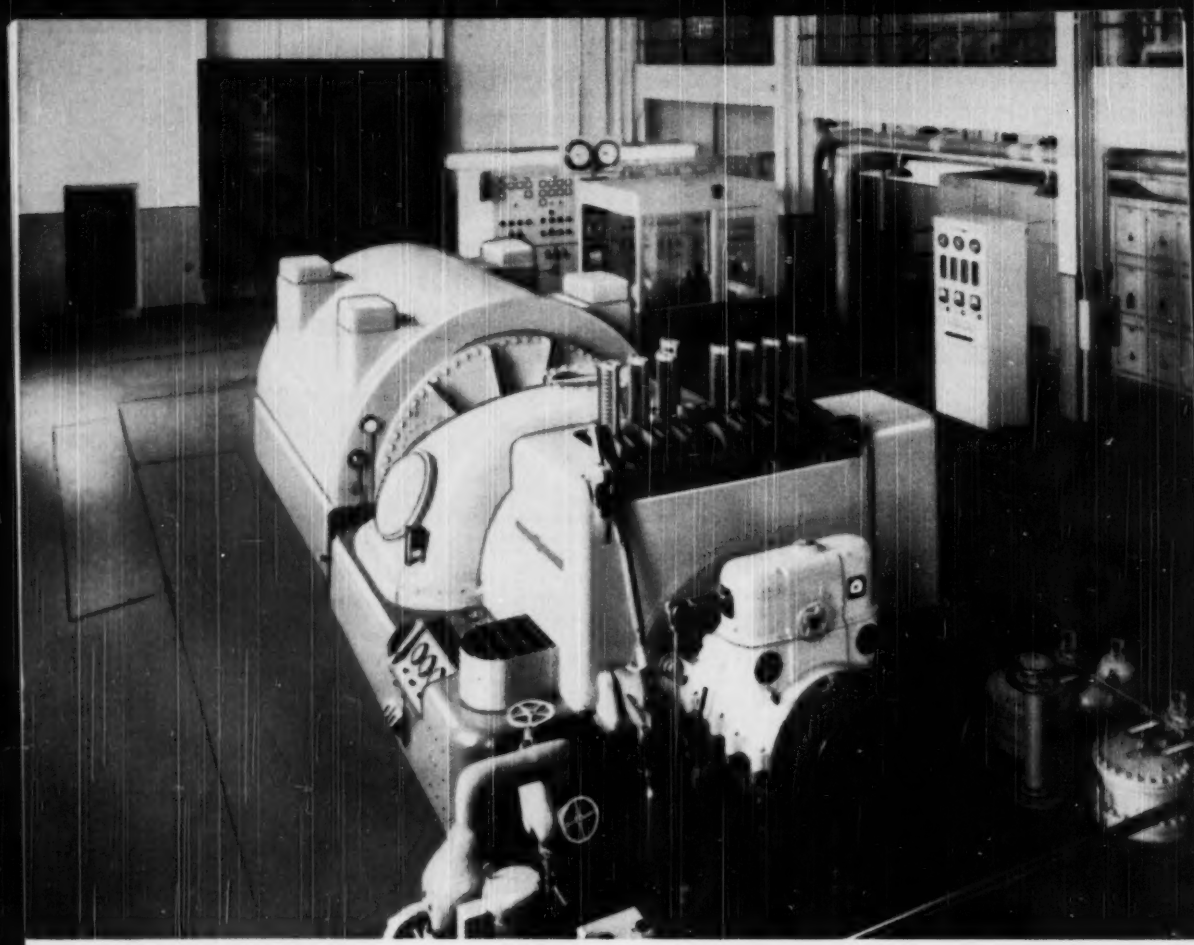
MAIN OFFICE AND FACTORY — 2400 Block, Fulton St., Chicago 12, Ill.
NEW YORK OFFICE — 140 Cedar St., New York 6, N. Y.

DISTRICT REPRESENTATIVES IN THE FOLLOWING CITIES

Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Charlotte, N. C.
Cleveland, Ohio
Dallas, Texas
Denver, Colo.
Detroit, Mich.
Indianapolis, Ind.
Jacksonville, Fla.
Kansas City, Mo.
Knoxville, Tenn.
Los Angeles, Cal.
Minneapolis, Minn.
Norfolk, Neb.
Norfolk, Va.
Philadelphia, Pa.
Pittsburgh, Pa.
Richmond, Va.
Roanoke, Va.
St. Louis, Mo.
San Francisco, Cal.
Seattle, Wash.
Tampa, Fla.
Washington, D. C.
Honolulu, Hawaii

CANADIAN ASSOCIATE

Canadian Line Materials Limited — Toronto 15, Canada



New turbine is slated for trouble-free life

IN 1949 when this 21,000-KW turbine was put in operation in a midwest power company, officials saw no problem in keeping maintenance at a rock-bottom low. Experience covering 16 years' operation convinced them that they had the answer—NONPAREIL Turbine Oil. They had already put NONPAREIL into three 5,000-KW units—in 1933, in 1935, and in 1940, respectively.

To this day the oil in these units has not been changed, yet there have been no oil-deterioration troubles, no deposit troubles, no high-acidity troubles. In fact oil neutralization numbers have remained below 0.10 mg. KOH/gm.

Consider that record as applied to minimizing your maintenance and costs . . . no oil replacements, no removal of oil for treating, no downtime for cleaning oil systems that stay entirely clean. Moreover, there is no time limit on these benefits. You will receive with each fill of oil a written guarantee that NONPAREIL Turbine Oil will last as long as your turbine, and that its neutralization number will stay below 0.15 mg. KOH/gm.

Have a Standard Oil lubrication specialist show you service records that, in each case, cover 21 years of continuous operation on NONPAREIL Turbine Oil. Ask him for case histories that show how NONPAREIL has reduced utility lubrication costs as much as 68%. You can reach a lubrication specialist through your local Standard Oil Company (Indiana) office. Or, if you wish, write:

Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.

NONPAREIL
TRADE MARK
Turbine Oil

STANDARD OIL COMPANY (INDIANA) STANDARD